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Representatives of the railway commissions of five states met at Chicago recently and issued a manifesto on the subject of the safety of pedestrians on railway tracks. The records of the great number of deaths and injuries were reviewed, and the conclusion was reached that the legislatures will not act until the state railway commissions insist on action. This is an elementary truth which it is well to state; but will the lawmakers act, even after the commissions do "insist"? The problem is a very difficult one. In the doings of this conference, as published, too much stress is laid on the passage of laws. As everyone knows, the need is not so much for new laws as for the enforcement of old ones. The commissioners seem to appreciate this, but apparently not with sufficient force. They suggest that the police power be given to track foremen the same as it is now given to conductors of trains; but that would be only to scratch the surface of the question. The most valuable function of a state railway commission is to elucidate and publish useful facts, which, if not made plain by experts, will not be known or appreciated by the public; but in this case the facts which ought to be heralded are hard to get. For example, why are magistrates so lax in their treatment of trespassers who are brought up for trial? Why do juries give a trespasser a verdict for damages, when in justice the railway ought to recover damages from him? What different treatment should be accorded police officers and constables to induce them to voluntarily and habitually arrest lawbreakers? Why do people like to risk their lives for the purpose of saving forty seconds at a crossing? How can a railway of moderate size raise $500,000 this year with which to abolish grade crossings and at the same time accept $500,000 *less* for passenger fares than it received last year? How accurately do these commissioners interpret public sentiment when they mourn over the loss of the lives of 5,000 trespassers yearly? Are not ninety-nine out of every hundred people entirely resigned, calm and satisfied under the present situation?

In refusing authority to the Delaware & Hudson to issue its own bonds to take up notes which were sold to provide money for the purchase of, in one case coal property and in the other an electric railway, the New York Public Service Commission, Second District, by no means finally passes on the general question of the propriety of the refunding of securities issued before the new Public Service law. The lack of general underlying principle is emphasized by granting permission to issue bonds to refund securities sold for the acquisition of certain other properties previous to the passage of the new law. In the case of advances made to the coal company, all of whose stock is owned by the Delaware & Hudson, the argument of the commission runs smoothly. If these advances are to be funded, the mortgage should rest on the coal property and not on the railway company. The coal company's property is valuable and could be mortgaged. The argument is not so plain when it comes to the advances for the acquisition of the Hudson Valley electric property. It is pointed out that there has been some juggling with the stock of the United Traction company so that the notes were not issued directly for the acquisition of the Hudson Valley property, but this is a detail. All the evidence seemingly goes to show that money was advanced by the railway company for the legitimate purpose of buying the property of the Hudson Valley company, an electric road, which in part parallels the steam railway. The purchase was made in good faith. The property as it stood may not have been worth the purchase price to anybody else, but at that time the directors had a perfect right to judge of its value to the railway company and to pay the necessary price. As the Hudson Valley company is operating at a loss now, it is hard to understand how the company itself could dispose of securities to reimburse the railway for advances made to it, and the notes now outstanding are an undoubted obligation of the railway company. In the case of the purchase of the Troy & New England, the Public Service Commission has permitted the railway company to issue its own bonds to refund notes sold for the acquisition of this property. The difference in the two cases narrows down either to a difference in the value of the properties or a difference in the use to which they were to be put. The commission argues that the ownership of the Troy & New England is advantageous to the railway company, since it is in the legitimate line of an extension. The purchase of the Hudson Valley company is not a good bargain and should not be made a charge on the railway company. Of course it is entirely too much to expect of the paternal government by commissions, that it should only inquire as to the validity and propriety of the note issue at the time it was made, and not try to go behind and determine for itself whether the purchase made in good faith is now of advantage to the railway company. This would be entirely too simple an argument, but as long as the inquiry has been made so carefully as to what is for the ultimate good of the railway company, why shouldn't the Public Service Commission at least help the officers of the company out by suggesting a way in which notes like those issued for the Hudson Valley company's property could be properly and legally refunded?

CONNECTICUT'S PUBLIC UTILITIES BILL.

The state of Connecticut is a commonwealth which has had her full share, and somewhat more, of railway and street railway problems to solve, and especially those problems which relate to public necessity and convenience. She has also, unfortunately for herself, been one of those states where a railway commission vested with ample permissive powers has been allowed to become a political and partisan body, inefficient in practice and bearing, among other sins of omission, the blame for an enormous volume of street railway stock watering. As a logical outcome the question of imperfect supervision of public utilities corporations became in the last legislature a burning one. The Governor of the state took an active hand and threatened during the last weeks of the session to call an extra session unless something was done. The result was a public utilities plan by indirection. A special commission of five was named to consider the subject and report to the legislature which is to meet at some time during the present month. Its work, after a number of public hearings, is now at hand in the draft of a bill filling 74 pages and providing for a public utilities act and a commission that is to succeed the present body which has purview only of steam railways and street railways.

As the latest product of the general tendency during the last two years to enlarge in this country the scope and functions of public service commissions the proposed Connecticut act, though not yet law, is interesting and significant. As was to be expected, it enlarges the area of supervision by adding gas, electric, water, express, telephone and telegraph corporations to the new commission's charge. But the commission remains with but three members who, while the objects of supervision are greatly increased, have but small increase except at one point—rates—of actual powers. At the vital point, however, of a higher *personnel* conditions are bettered. Salaries are raised from the present $3,000 a year to $7,500; the old proviso for a lawyer, civil engineer and a "business" man on the commission gives place merely to "three competent persons" subject to removal by the Superior Court for "misconduct, material neglect of duty or incompetence" on complaint of the Attorney-General; the term of service is lengthened from four to six years; and the general assembly with its two houses, instead of the senate alone as now, must confirm the Governor's appointment. The idea of making the appointment subject to the veto of the popular legislative body is obvious and somewhat suggestive. The salaries and costs of the Connecticut commission are now taxed on the railway and street railway corporations. Under the new measure the state pays them and wisely. Not so clearly wise is a proviso which excludes from the commission any stockholder of a company which is subject to the commission's supervision. The man not a shareholder in a railway, electric, gas, water, telephone or telegraph company yet fit for a utilities commission is a rare and unique character; and, if he is a shareholder and forced to reinvest to qualify, his field of reinvestment is certainly limited, and what is more serious for him, likely to be unfamiliar.

After the state's rough experience in trolley stock watering a drastic enactment against hydraulics was to be looked for. In the new bill it is forecast in provisos that no securities can be issued other than for cash or for "property found by the commission to be of equivalent value," nor shall any stock be issued at less than par nor bonds at less than market value as determined by the commission. Stock and scrip dividends are specifically prohibited and bonds—except for refunding—cannot be issued to an amount exceeding capital stock actually paid in. It will be seen that the stock issue feature does not go to the length of the Massachusetts statute which compels sales at or in practice, very near the market price; and issue of a high-priced stock at par, that is to say, cutting a "melon," evidently is not treated in the Connecticut bill as a stock dividend even qualifiedly. The experience of Massachusetts in this direction and the finding of the special commission of that state against the "market value" restraint on new stock seem to have reached over the southern state boundary. If a corporation wants to lease or buy out another corporation it can do so, but, of course, only for "equivalent value" as found by the commission, and it must have a special permit from the commission if the property is bought with stock, bonds or notes running more than 12 months. This lets a corporation buy out another with very short notes, but at the later risk of running the "equivalent value" gauntlet—a somewhat novel provision.

The sections of the proposed act which make for publicity and honest returns are very severe on their face, less so when more carefully scrutinized. Twenty-five per cent. of the outstanding stock, bonds or notes can call on the commission for a special examination or the commission may examine on its own initiative, may employ experts and call for persons and papers under subpoena. When returns of the companies seem defective or erroneous the commission may require their correction. The old law has too many of these "mays" in place of "shalls" and "musts." Why they reappear so often with the merely permissive features which in the past have been at the root of so many of Connecticut's troubles with the public utilities corporations is hard to understand. Had the features of the existing law in comparatively few cases been mandatory instead of permissive the state would hardly be seeking a general utilities commission now. It would have been a question of an improved type of commissioners rather than of amplified law. Finally the new bill takes the state on her first excursion in regulating rates which, after hearing, can be fixed by the commission on appeal of municipal authorities. But from any order of the commission relating to rates or any other matter either party at interest can appeal to the state courts.

These four subjects—the make-up of the commission, capitalization, publicity and rates—represent the salient points of public interest in the voluminous new Connecticut measure. Collectively they show good tendencies and good aims but always with the modifying fact that the ounce of personality in a commission outweighs in practice the pound of law.

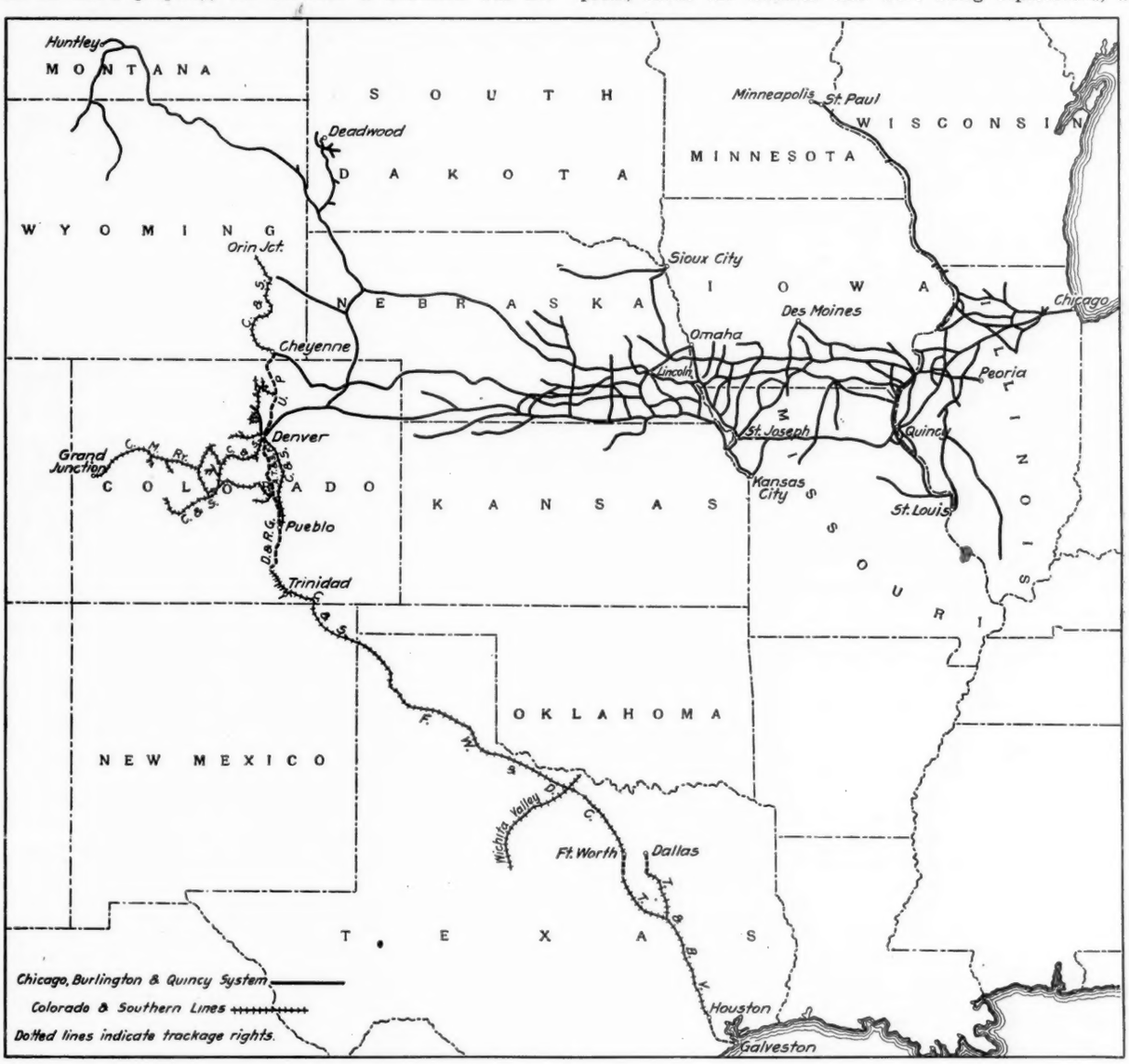
THE COLORADO & SOUTHERN PURCHASE.

The recent acquisition of the Colorado & Southern by the Chicago, Burlington & Quincy through a purchase for cash of a controlling interest in the $31,000,000 common stock, gives the Hill roads their much-talked-of outlet to the Gulf. The advantages of such a purchase by the Burlington are obvious from an examination of the accompanying map, and from the history of the Colorado & Southern, its somewhat conglomerate character is explained. In 1890 the Colorado Central, the Georgetown, Breckenridge & Leadville, the Denver & Middle Park, the Denver, Marshall & Boulder, the Greeley, Salt Lake & Pacific, the Denver, Texas & Gulf, the Denver, Texas & Fort Worth, the Road Canyon, the Chicosa Canyon, the Canyon Agua, the Colorado Central of Wyoming and the Cheyenne & Northern were consolidated and incorporated as the Union Pacific, Denver & Gulf, with a total of 915 miles, owned and controlled by the Union Pacific. The names of the constituent roads are expressive enough to one who knows the geography of Colorado. Most of them were short lines; many built without any real prospect of being able to originate any profitable traffic, and a great number of them with almost impossible grades.

In 1893 the property was placed in the hands of receivers, and in December Frank Trumbull, now president of the road, was made receiver, and Grenville M. Dodge became chairman of the consolidated bondholders' protective committee. In 1898 the Julesburg division was sold to the Union Pacific. In January, 1899, the new company, the Colorado & Southern, took possession of the old U. P. D. & G, and also of the Denver, Leadville & Gunnison, the total mileage operated at that time

being about 1,141 miles. This included trackage rights over what is known as the Julesburg division of the Union Pacific, giving the C. & S., as will be noticed on the map, an entrance from Denver into Cheyenne. The company also acquired a majority of the capital stock of the Fort Worth & Denver City, whose road extends from Texline, Tex., to Fort Worth. From this time on the interests controlling the Colorado & Southern were closely connected with the Chicago, Rock Island & Pacific. In August, 1905, the company bought the Trinity & Brazos Valley, extending from Cleburne, Tex., to Mexia, and later sold a half interest to the Rock Island company, and, as will be seen from the map, the company has trackage rights into Houston, Tex.

As an allied property, the Colorado & Southern was not particularly useful to the Rock Island, except in so far as it gave the Rock Island the best terminal property in Denver. As the road has been operated in the last two or three years, it might fittingly be described as a snug, independent trunk line between Colorado and the Gulf, and as such was remarkably successful in operation. The loss, then, to the Rock Island interests is not great, but the gain to the Burlington should be important. Of course, it would be possible for the Union Pacific to refuse to grant trackage rights any longer into Cheyenne, but Mr. Hill would have no difficulty in building his own line, or rather in extending one already partly built, and he now has fine terminal properties both in Denver and in Houston. Joint control of the Trinity & Brazos Valley could be used against Mr. Hill by the Rock Island, but if Moore-Hawley interests had been opposed to the Burlington's entrance into Gulf territory, it seems unlikely that the sale would have been made.



The Chicago, Burlington & Quincy and the Colorado & Southern.

THE NEW HAVEN ELECTRIFICATION LOG.

From the opening of the electric service on the New Haven road, in July, 1907, right up to the present there have been many rumors current, appearing periodically in the daily press, about the troubles that were being experienced, and the conclusions drawn varied from prognostications of absolute failure and breakdown to a glossing over of what was happening as a mere trifle, that could be easily remedied. During this period, also, the suburban travelers have been loud in their complaints regarding defective service. Meanwhile, the technical press, in the absence of accurate and authentic information, has been almost silent, and comment on the part of those most interested, whose decision would be of the greatest value, has been withheld. Rumor said that

there had been trouble, and that was about as far as information went.

With such a condition existing, it was a wise and far-sighted move on the part of the railway company to release such a paper as that of Mr. Murray on the log of the New Haven electrification, which appears in another column. Publication of this important document, and adequate comment on it, has been delayed because of the press of matter involved in the production of the annual statistical number, which appeared last week.

It is safe to say that a paper of this character has never before been presented to any scientific association. It has long been a platitude among engineers that one learns more from his failures than from his successes; and here comes a clear, honest and wholesome record of trouble and failure in the case of a great undertaking, capped by a statement of the means that were taken to avoid further trouble and turn failure into success. This is a bold thing to do, and probably would not have been done did the engineers and contractors and railway officers not feel that success was now not only assured but already at hand.

To the mechanical and electrical engineer, the story of the paper is invaluable. It shows the progress of events; how unexpected matters had to be taken in hand and developed because the chain of parts did not act as each individual link had acted by itself and gave promise of acting in unison with others. The paper is remarkably free from assumption and statement of opinion, and is confined almost exclusively to the facts of operation and the means of betterment employed, and it is only towards the end that the writer states that the burden of proof as to which may be the better system has been shifted from the alternating single-phase to the direct-current system. This statement is followed by a summary from which the inference may be drawn that the New Haven operators believe the single-phase system to be the one of the future for heavy trunk line traffic, while they consider that the direct-current will probably hold its own for street and urban service.

From the log that is published, it appears that the power house troubles, at least those of a serious nature, have been entirely overcome, and that, in the future, there will only remain those that are apt to arise in any station of such magnitude, which are to be expected in the regular course of events. The line, too, has been put in such shape that the early troubles have about disappeared, and it only remains to tune up the locomotives, and by making such changes as experience will suggest from time to time, develop them towards a point of maximum efficiency and minimum cost of repairs. Of course no statement can yet be made that will indicate where these boundaries are. At present, the cost of repairs per mile are falling, but, owing to the youth of the service, they have not yet touched the figures reached elsewhere. Consequently, a further decrease is expected, prior to a later rise, when the locomotives commence to be taken in for general repairs.

It is shown, too, that these engines are well up to and even surpass the builders' guarantees, as evidenced by the remarkable work done on Labor Day, 1908, when the average mileage for the 38 locomotives in service was 212 for each, with some making more than 300 miles, and this with a maximum distance of 34 miles between terminals.

The paper, as we have said, deals almost exclusively with the facts relating to the locomotive and the electrical equipment behind it, and stops there. It shows that both of these have been brought to a condition of satisfactory efficiency; a condition where the safety of the public and of the employee is well cared for, and where train delays will probably be no greater than must be expected where so heavy a traffic is to be cared for. There is nothing in this to indicate the relations of the locomotive to the rails, or whether the track must be of a more or less substantial character than it is where the steam locomotive is used. The discussion regarding this matter, that flourished so vigorously a year ago, has well-nigh died out, and we are assured that all is well, though there is an omission to state whether or not that "well" is obtained as the result of an abnormal strengthening of the track, and a corresponding increase of expense for maintenance.

But this aside, the presentation of the case of this greatest of single-phase operations with so much frankness is a matter upon which all who are interested in electric traction in any way are to be congratulated, and it is to be hoped that the example that has thus been set will be followed by others who have a tale to tell of woes encountered and overcome, since, by the telling, many may be guided in their work and thus avoid the pitfalls that will otherwise surely lie in their way.

To sum up the matter, it is evident that the New Haven engineers believe in the system that they have installed. At the same time, it is quite natural that all should not agree with Mr. Murray's conclusion, and that such differences of opinion should be brought out in the discussion. This was the case, and that side of it will be presented next week, since the limits of space prevent it from being done in this issue. We shall also welcome correspondence and further discussion in our columns.

UNION PACIFIC.

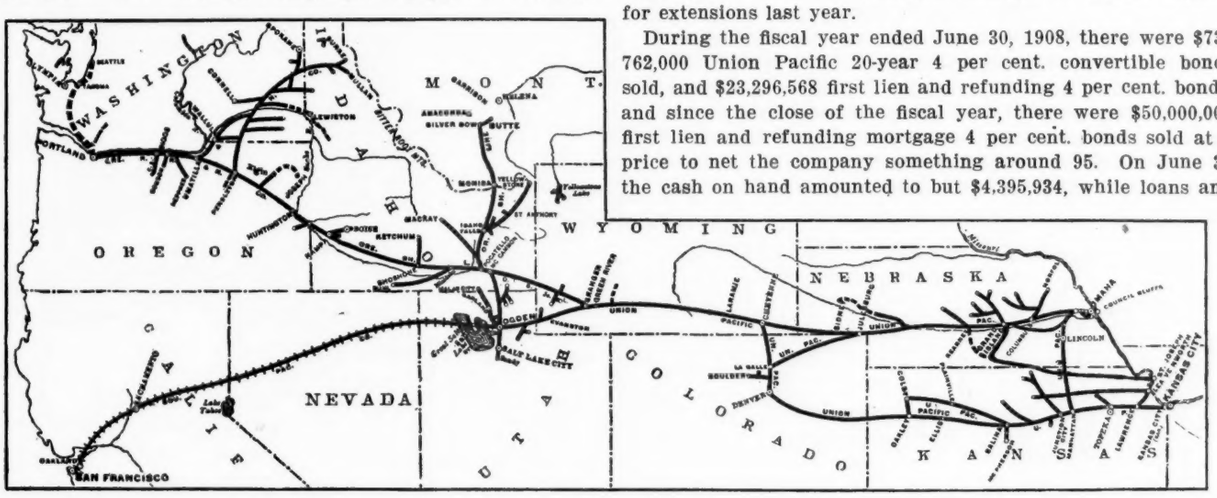
From the point of view of the stockholders, although there is a sharp distinction between the Union Pacific as a holding company and as an operating railway company, the separation of these two functions and the examination of one alone is absurd. This is not so to the practical railway man. In our review of this company's operation for the 1907 year, we pointed out this distinction between the banking and the operating activities of the company and commented on both. While it is impossible entirely to ignore the banking features of this year's report, since, for instance, the ability of the company as an operating company to get new capital for additions and betterments may depend upon its credit as a banking company, still, from the railway man's point of view, the principal interest lies in what has been done by the railway organization, operating continuous mileage from Omaha, Neb., and Kansas City, Mo., to Spokane, Wash., and Portland, Ore.

Covering such vast territory, and handling such an enormous amount of all classes of freight, the Union Pacific reflects quite accurately business conditions. Its problems have been the problems of the railways of the country on a large scale, and its solution of these problems must be the admiration of operating officers. Increased efficiency was the aim, especially of the second half year's operation. From July 1, 1907, nearly to January, 1908, the business offered was extraordinarily heavy. Labor, materials and supplies were not only expensive, but were actually scarce, and the demand for railway equipment was in excess of the supply throughout the larger part of the United States. Thus the tons of revenue freight carried one mile amounted to 3,065,584,431 for the six months ended December 31, 1907, an increase of about 7.5 per cent. over the tonnage in the corresponding six months of the previous year. The falling off in business of the Union Pacific in the second half of the fiscal year is plainly brought out by a comparison of the tons of revenue freight carried one mile, amounting to 2,206,355,382, for the six months ended June 30, 1908, with the tons carried for the corresponding six months in the previous year. This comparison shows a decrease of 22.6 per cent. No harder strain could be put on the operating organization of the road than this; yet the rail lines were operated on a basis of 54 per cent. last year as compared with 52 per cent. in the previous year.

Taken as a whole, operating revenues decreased but 0.35 per cent., and amounted to $76,039,225 last year, and total

operating expenses increased by less than 4 per cent., amounting to $41,694,035, and since the close of the fiscal year, the showing has been much better. One cause for the increase in operating expenses was an increase of nearly 12 per cent. in the number of revenue passengers carried one mile, the total number being 760,532,906 last year. The handling of this increased passenger traffic was of course a direct charge to conducting transportation, while the decrease of 7.6 per cent. in tons of revenue freight carried one mile, the number being 5,271,939,813 last year, was partly offset by an increase in the empty freight car mileage. The revenue from the passenger business amounted to $16,641,468, an increase of 11.6 per cent. over the previous year, and the revenue from freight amounted to $52,899,158, a decrease of 3.5 per cent.

The increase in revenue from passengers came almost entirely from the increased number of passengers carried, since the average distance each passenger was carried totaled 118 miles last year as compared with 120 miles in the previous year, and the receipts per passenger per mile were 2.188 cents in 1908 as against 2.189 in 1907. The decrease in revenue from freight came from a decrease in the number of tons carried and a slight decrease in the length of haul, the average haul being 403 miles last year as against 405 miles in the previous year. The increased receipts per ton per mile of 1.003



The Union Pacific System.

The Southern Pacific connection from Ogden to San Francisco is shown.

cents last year as compared with the already very high receipts of 0.96 cents per ton per mile in 1907, indicate the high grade freight carried. Unfortunately there is no table classifying by commodities this freight tonnage.

The increase in operating expenses already mentioned came largely from increased cost of conducting transportation, this account showing an expenditure of $21,214,179 last year, nearly 13 per cent. higher than in the previous year. The principal increase was in the cost of fuel for locomotives, for which $6,582,430 was spent last year as against $5,169,702 in the previous year, an increase of 27 per cent. While this is the largest increase in transportation expenses, it is only typical of the others, every item shown under this head having increased. There was no attempt to cut maintenance charges to improve the showing of the road at the expense of proper up-keep of the property. The following table gives the costs of maintenance of way per mile operated, and the unit costs of repairs and renewals of equipment:

	1908.	1907.
Maintenance of way	$1,539	$1,782
Repairs and renewals of locomotives	3,069	2,933
Repairs and renewals of passenger cars	1,037	1,092
Repairs and renewals of freight cars	113	127

These expenditures are liberal in the extreme when compared with the Union Pacific's competitors and would be considered ample for an eastern trunk line.

Notwithstanding the increase in empty car mileage, the average train load was 512 tons last year, an increase of 37 tons, or 7.8 per cent., over the previous year. Another saving is shown in the reduction of the ratio of light and helping locomotive miles to revenue service total train miles, this ratio being 8.06 per cent. last year as compared with 8.98 per cent. in the previous year, a decrease of over 10 per cent. The average number of loaded cars in freight trains going east and north was 22.17 as against 21.91 in the previous year; going west and south, 23.33 as against 22.98. This increase in loaded cars in train and in revenue freight train load reflect the advantages derived from the improvements made during the past years in the grades and curvatures.

During the past year, this policy of improvement of grades and curvatures was carried on, and $5,688,877 was charged to capital account for additions and betterments. Of this, $1,800,645 was spent for additional main track. The Union Pacific has been steadily building second main track for the last few years, and will in time be a double track road from the Missouri river to Ogden, Utah. The policy of the Union Pacific, as we have pointed out before, has been one rather of improvement than of extension, although extensions that are a direct benefit to existing lines have not been neglected. There was $3,662,929 charged to capital account for extensions last year.

During the fiscal year ended June 30, 1908, there were $73,762,000 Union Pacific 20-year 4 per cent. convertible bonds sold, and $23,296,568 first lien and refunding 4 per cent. bonds, and since the close of the fiscal year, there were $50,000,000 first lien and refunding mortgage 4 per cent. bonds sold at a price to net the company something around 95. On June 30 the cash on hand amounted to but $4,395,934, while loans and bills payable amounted to $41,189,646. This is a reduction in the loans and bills payable from $69,050,220 shown on June 30, 1907. The Union Pacific during the year loaned the Southern Pacific $42,376,389, the total amount of this demand loan amounting to $45,376,389. The demand loans of the San Pedro, Los Angeles & Salt Lake, representing money advanced by the Union Pacific, amounted to $2,625,308 on June 30, 1908, as compared with $50,000 on the same date in the previous year.

The profitableness of the Union Pacific's investment business is indicated by a balance of $16,019,692, income from other than transportation operations. This is greater by $4,790,468 than income from this source last year, so that the surplus of $12,188,752 after payment of dividends was only slightly smaller than the surplus in 1907.

Since the close of the fiscal year, reports of the Union Pacific to the Interstate Commerce Commission have shown steady increases in business and decreases in expenses, and prospects for the present fiscal year are much better than were the prospects at this time last year.

The following table shows the results of operation of the Union Pacific and its auxiliary companies, rearranged according to our usual method. The figures are all taken from the 1908 annual report of the company, and may in some cases

be rearranged so as to no longer correspond with those published in the 1907 report:

	1908.	1907.
Average miles operated	5,781	5,645
Freight revenue	$52,899,158	$54,809,074
Passenger revenue	16,641,468	14,912,508
Total operating revenue	76,039,225	76,308,598
Maint. of way and structures.	8,898,301	10,022,748
Maint. of equipment	7,991,447	7,867,081
Transportation	21,214,179	18,780,080
Total operating expenses	41,694,035	40,148,478
Taxes	2,444,726	2,076,945
Net revenue	31,900,464	34,083,075
Gross income	47,920,156	45,553,206
Net income	35,719,400	36,176,921
Dividends	23,530,648	23,530,036
Additions and betterments	.....	1,959,002
Surplus	12,188,752	10,687,883

NEW PUBLICATIONS.

Index to Railway Documents of the State of New York.

The Carnegie Institution of Washington is publishing an index of economic material in documents of the states of the United States. The New York documents, from 1789 to 1904, are being indexed and prepared for the Department of Economics and Sociology of the Carnegie Institution by Adelaide R. Hasse, Librarian of the Department of Public Documents of the New York Public Library. This index is of the highest value and gives a good illustration of the extremely important work which the Carnegie Institution is undertaking in furnishing aid for work of this sort, which will not bring in a direct money profit to any publisher, but will be of the highest national value.

The documents relating to railways in New York state in the index at hand are indexed in several different ways, and the system followed is good and clear.

Letters to the Editor.

JURISDICTION OF I. C. C. QUESTIONED.

To the Editor of the Railroad Age Gazette:

The attempt to find scriptural authority for the Interstate Commerce Commission, apropos of the Santa Fe pass, in your issue for December 18, will not bear analysis. The passenger who "paid his fare and went" was the disgruntled prophet Jonah. He embarked for Nineveh upon a water line engaged in foreign traffic, and therefore not amenable to the Commission. At an early stage of his voyage he was discovered in the hold and summarily ejected over the side of the vessel, without, so far as is related, receiving any refund. Upon his arrival in the water he was taken as a free passenger by a great fish over which the Commission will hardly claim jurisdiction; though what might be said on that point by a higher Federal authority can only be guessed. It certainly was not a common carrier. The unregulated "great fish" carried its deadhead passenger safely to shore.

The moral of this story to all who pay their fare is almost too obvious for comment. It is better to stay at home unless you can travel on a pass. The next time Jonah started for Nineveh he walked.

C. H. ALKHAT.

It is painful to have our clear and cogent logic so ruthlessly "knocked"; but a railway man who has failed to get his annual renewed is to be pardoned many things.—Editor.

PASSES AND THE SCRIPTURES.

Omaha, Neb., December 23, 1908.

To the Editor of the Railroad Age Gazette:

Referring to the editorial on passes in your issue of December 18, page 1,570, your Santa Fe official didn't look close enough. The weight of the Biblical evidence is against him, as well as common sense. Had he turned to the Book of Exodus he would have read that the Israelites were *passed* through the Red Sea, and in the Book of Joshua, that they were *passed* through the Jordan. That number of free travelers would have made his pass book look sick. When the Lord sent out the seventy He said: "Carry neither purse, nor scrip, nor shoes * * * and into whatsoever house ye enter first say: 'Peace be to this house' * * * And in the same house remain, eating and drinking such things as they *give* * * * ." Doesn't this mean a pass"? Again, in Matthew x:8, he says, "freely ye have received, freely give." Does this mean that the Santa Fe official shall receive passes freely and give none in return?

As you will remember, Jonah was in a hurry when he paid the fare and went. But he was forced to change his route, and was given a free ride before he reached the dry land. He had a "pass" part of the way. All of the "redeemed" are to be passed through the celestial gates. The Psalmist says: "Open to me the gates of righteousness; I will go unto them." As he had the right to be passed, is the Santa Fe road so much better that it will compel the righteous to pay their way?

That official ought to study his Bible, because "Salvation is free," if railway rides are not. Even Isaiah says: "Ho, every one that thirsteth * * * come, buy wine and milk without money and without price." Seriously, the rule against passes is too severe. It is sectionalizing the people. We had enough of sectionalism in 1861-65. A more judicious, liberal system should be adopted.

E. F. TEST.

As the value of the scriptures depends so largely on their being thoroughly studied, this exegesis from Omaha, in past years sometimes looked upon as a wicked city, is most welcome. Here we have authoritative assurance that the pass privilege rightfully applies also to dining cars. What could be more comforting? The Interstate Commerce Commission should reverse its policy and use its influence with Congress to have the law modified.—Editor.

PRIVATE CARS.

Chicago, Ill., December 14, 1908.

To the Editor of the Railroad Age Gazette:

In a paper read before the meeting of the Association of Transportation and Car Accounting Officers at Cincinnati, December 8, 1908, Robert J. Bailey, Secretary of the Individual Car Owners' Association, attempted to prove that the railways of the United States shirked their duty in failing to provide equipment sufficient to take care of the increase in traffic from 1904 to 1908, and that it devolved on the individual car owners to come to the rescue of the suffering public.

In support of this claim, Mr. Bailey presented several pages of fragmentary statistics, and summed up his deductions in the following paragraph:

"The increase in the building of freight cars is shown as 20.5 per cent., and the general increase in coal and pig iron of the United States in the same period is 41 per cent. The difference in percentage of cars actually built and that which was required is equal to about 200,000 freight cars. This statement bears additional significance from the fact that there are over 200,000 privately owned freight cars in the United States."

Even admitting that Mr. Bailey's figures approximate accuracy, it would be interesting to learn who handled this enormous surplus for which the railways failed to provide cars. It is obvious that these commodities, if produced, were transported somewhere and by someone.

Mr. Bailey does not claim that these 200,000 private cars all came into existence since 1904. In fact, according to Mr. Midgely, not less than 125,000 of these same private cars

were doing business as early as 1901, so that at best the private cars took care of but little more than their proportion of the increase.

As a matter of fact, however, Mr. Bailey not only uses incomplete and inaccurate figures, but he uses them in such a manner as to produce results that are misleading, to say the least.

It is noted that the 20.5 per cent. increase in equipment referred to applies to all classes of cars, while the 41 per cent. increase in production covers coal and pig iron only. According to Mr. Bailey's figures, he shows an increase of only 29 per cent. in general commodities. It is noted also that the increase in commodities is calculated in tons, while the additional equipment is expressed in cars. It is hard to believe that a man in Mr. Bailey's position could overlook the increase in tonnage capacity of the freight car equipment of the country. In fact, as he refers to this increase in another part of his paper it is most curious that he fails to consider it in connection with the increase in the number of cars.

The Interstate Commerce Commission furnishes very complete statistics covering this particular question. Taking first all classes of cars, we find that from 1904 to 1907, the total freight car equipment (excluding private cars), increased from 1,668,341 to 1,991,557, a numerical increase of 323,216, or 19.4 per cent. The increase in total capacity, however, was much greater. In 1904 the average capacity of all cars was 30 tons. The Interstate Commerce Commission figures for 1907 are not yet available, but reliable figures from another source place the average for 1907 at 34 tons. Combining the numerical increase with the increase in capacity, we have a total increase in tonnage capacity of 16,953,805 tons, or 33.4 per cent.

Taking coal cars alone the discrepancy between Mr. Bailey's deductions and the cold facts appears much wider. In 1904 the Interstate Commerce Commission reports 622,568 railway coal cars in service, the capacity of these cars averaging 33 tons. Neither the number nor the capacity of this class of cars for 1907 has as yet been made public by the Interstate Commerce Commission, but assuming the number as 38 per cent. of the total cars, and the capacity at 39 tons per car (based on reliable data from a private source) the increase in coal carrying capacity is from 20,760,045 in 1904 to 29,514,849 in 1907, an increase of 8,754,804 tons, or 42.2 per cent.

Mr. Bailey attempts also to show that railways get the bulk of all of the profit which is derived from the coal business. He says:

"In our particular commodity of coal we figure our net earnings not to exceed 15 cents per ton. The shipments of lake coal during 1906, including those to Erie, Ashtabula, Cleveland, Huron and Toledo, amounted to a total of over 14,000,000 net tons. The shipments made to Erie, Ashtabula and Cleveland by one road produced a net revenue of $30 per car, on the basis of a 50-ton car. We furnish the coal and the car to transport it, and it nets us $7.50. The railway furnishes the rails and the transportation and it nets them $30. The difference is 43 per cent. in favor of the railway."

If there is any railway in that territory that can handle freight business at such a profit it has kept it pretty well concealed in the annual reports. It is probable that the rate on coal to the ports mentioned will not average over $1.10 per ton, or $55 for a 50-ton car.

To make a net profit of $30 per car the road would have to show an operating ratio of about 45 per cent., while the Interstate Commerce Commission shows the average for roads in that particular group as running 70 per cent. and higher for several years past.

There is a well-known adage relating to the inevitable truthfulness of figures. Unfortunately, no one has ever been able to convince us that the converse of the proposition also holds good.

STATISTICS.

RAILROAD TAXATION IN WASHINGTON.

Seattle, Wash., November 11, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

In the various states there is a great diversity in methods of taxing the property of public utility corporations, but few of which are fair to the tax paying public and to the public utility concerns, or satisfactory to either. The primitive method of appraising all property by local assessors, placing their valuations upon the tax rolls, and dividing the taxes for state, county and municipal purposes has been in use in the last few years in only three states, Rhode Island, Oregon and Washington. The trend of legislation and public opinion in most states is away from local taxation and towards taxation of public utility concerns for state purposes only.

Washington for the past few years has been making efforts to modernize its system of taxing public utility corporations. At the general election on November 3 a constitutional amendmend to provide "that taxes shall be uniform upon the same class of subjects and shall be collected and levied for public purposes," and which was passed by the state legislature in February, 1907, was lost by a considerable margin. For a state that has operating within its boundaries 32 steam and electric roads and numerous logging roads and tramways, the result is unfortunate, as it keeps the state committed to a system of corporation taxation that is inadequate and unfair.

In 1905 a state tax commission and a state railroad commission were established in Washington to endeavor to solve the taxation problem. These commissions made exhaustive reports. The many methods of taxation in vogue in the various states were divided as follows, there being 19 states having at least two methods, and some that have more, for levying corporation taxes:

Taxes for state purposes only	10
General property tax, state levy	35
General property tax, local levy	3
Tax on capital stock	4
Tax on capital stock and bonded debt	3
Tax on gross receipts	12
Tax on net earnings	1
Special taxes	4

The commission recommended that the direct tax for state purposes only be adopted.

This year railroad properties have been assessed according to the rate in each county upon a valuation in that county determined by the state tax commission. The assessments have been increased about 100 per cent. since 1907, but the tax rate has been slightly lowered. The intention of the state tax commission was to assess all railroad property at 60 per cent. of its value, but this was found to be higher than the valuation upon other property in any county, and it was therefore impossible to enforce a flat valuation of 60 per cent. against railroad property. Railroad property was then assessed in each county at the same rate as other property.

The aggregate assessment is $84,000,000 for steam and $14,000,000 for electric lines. In 1907 the aggregate for steam and electric lines, including both operating and non-operating property, was less than $44,000,000. The great and unfair variation of the tax rate for different roads and counties is shown by the county assessments of 51.6 per cent. in Spokane county, 46.7 per cent. in King county and as low as 23.4 per cent. in Chehalis county. Taking the railroad commission's figure for the actual value and the county assessment percentages, the Oregon & Northern is assessed for main line property at the rate of $9,763 per mile in Whitman county, $13,120 in Walla Walla county and $16,000 in Columbia county. The Northern Pacific ranges from $43,014 per mile in Spokane county to $25,598 in Skagit county. The Great Northern varies from $47,825 in Spokane to $26,237 in Skagit county. These variations cannot be remedied by the state board of equalization under the present system of county assessments, and the county assessors, limited as to time and powerless to make investigations necessary to a proper determination of value, cannot place a fair assessment upon railroad property.

The proposed amendment to the constitution aimed to give the state legislature power to tax the railroads as a whole without cutting them up into pieces and distributing them among the counties. The conclusion of the states that have handled the problem recently is that the satisfactory method for assessment and taxation of public service corporations is by a board appointed for that purpose and the best results are obtained by taxation of this class of property for state purposes only.

The development of Washington depends upon the development of its railroad systems. The Chicago, Milwaukee & St. Paul, the North Coast and the Oregon & Washington are all building extensively and their valuation will soon reach $150,000,000. Some method for taxing this property fairly must be provided. It is no longer a question of more law, but of less and more efficient law; not a question of elaborating and amplifying the tax systems, but a question of offering the least possible amount of national, state and local interference with the management of the railroads that is consistent with good service to the public. There is a tendency to forget that the "square deal" has two sides—the public side and the railroad side.

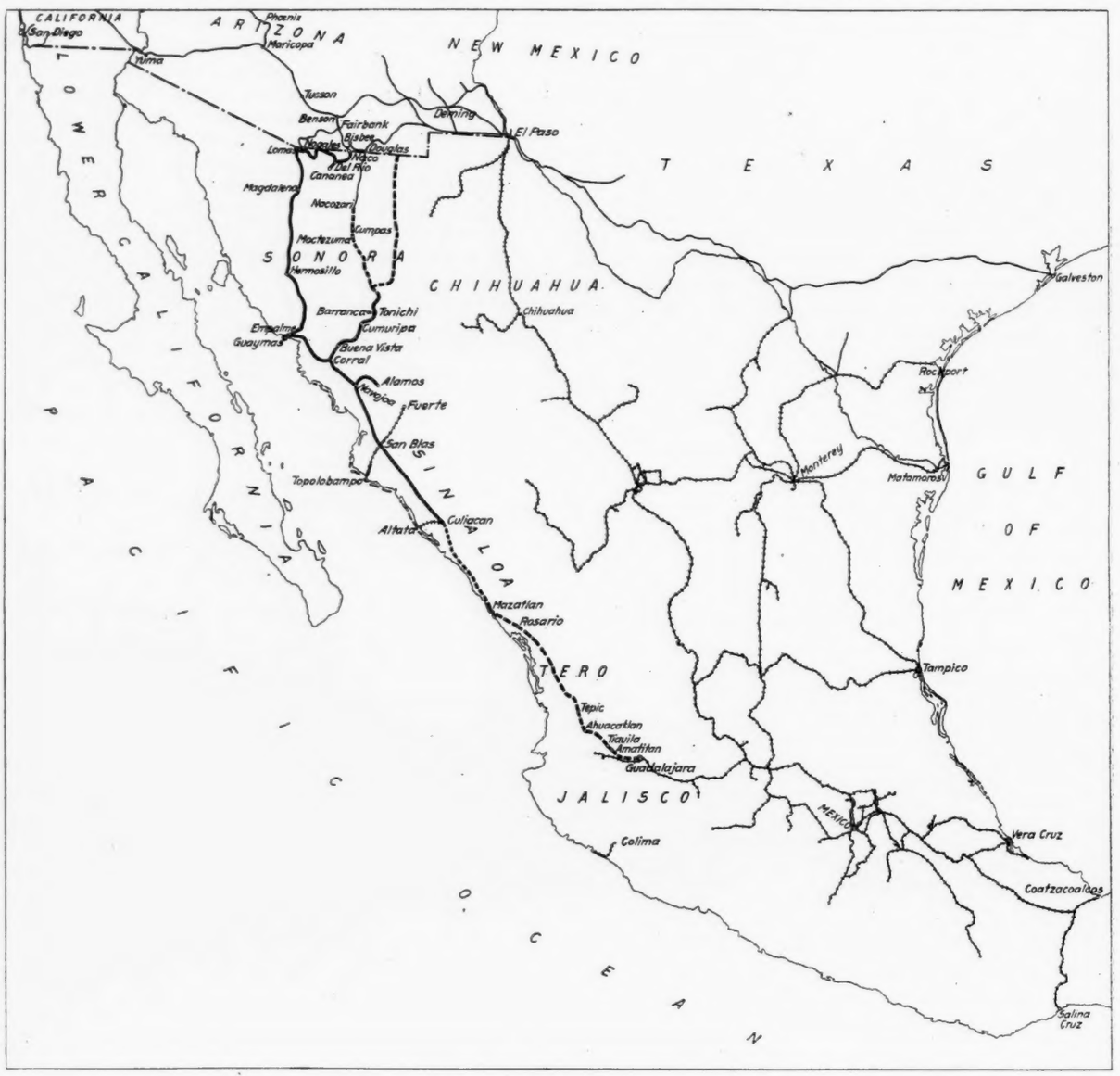
L. P. ZIMMERMAN.

Contributed Papers.

THE SOUTHERN PACIFIC LINES IN MEXICO.

The construction by the Southern Pacific Company of a main trunk line and various branches on the west coast of Mexico under concessions granted by the Mexican Government is one of the most important railway developments in America today. Six hundred miles of these lines are already completed and in operation; 170 additional miles will be finished and ready for operation by January, 1909, and the entire network of lines will be pushed to completion as rapidly as the best, most approved and most economic methods of building will permit. The enterprise is a gigantic one involving the expenditure of many millions of dollars. Perhaps the best evidence of its importance is the fact that the work has progressed continuously throughout the financial depression.

Besides opening up a new territory rich in natural resources, the completion of the main trunk line will establish a direct and continuous route connecting the City of Mexico, Guadalajara and other points in Mexico with Los Angeles, San Fran-



Map of the Southern Pacific Lines in Mexico.

Other principal Mexican railways are shown by the lighter, cross-hatched lines.

cisco, Portland and the ports of Puget Sound. This will make possible a continuous train service of about 3,500 miles, the longest north-and-south line in America, and the longest in the world, until the Cape-to-Cairo line is built (if it ever is!) by the British Government. In order to understand clearly the significance of the various lines embraced in the enterprise the main line will be considered first, and then the branches separately.

MAIN TRUNK LINE.

This line enters the Republic of Mexico at Nogales, the twin American-Mexican city on each side of the international boundary between Arizona and the State of Sonora. From this point the line of the Sonora Railway extends through

Natives Clearing the Right of Way.

Magdalena and Hermosillo to the port of Guaymas, on the Gulf of California, a distance of 263 miles. This line, which has been in operation for many years, is now owned and controlled by the Southern Pacific Company, and over its tracks the through trains will be run. The Government has recently granted a concession for the reconstruction of this entire line and the Southern Pacific has already concluded arrangements for raising the track, putting in new ties, reballasting, replacing the old bridges with new ones, and substituting heavy rails for those now used, so that the roadbed of this part of the line will be raised to the high standard of construction which prevails on the new part south of Guaymas. By the terms of the concession this reconstruction must be completed within two years from the date of the concession.

From Guaymas south to Guadalajara the entire line, 860 miles in length, will be one of original construction. Leaving Guaymas tne road has a general southeasterly course passing through Corral, the point of crossing the Yaqui river, and Navojoa, the crossing of the Mayo river, entering the state of Sinaloa about half way between Navojoa and San Blas, at which latter place the Fuerte river and tracks of the Kansas City, Mexico & Orient are crossed; thence to Culiacan, the capital of Sinaloa, crossing the beautiful Culiacan valley and river just before entering the city. From Culiacan the line proceeds to Mazatlan, situated on the Pacific Ocean at the mouth of the Gulf of California. This is the chief seaport city of the west coast of Mexico, and the only one which will have both a north and south rail outlet when the line is completed. Here the route gradually leaves the coast, passing through the territory and city of Tepic, thence to Guadalajara, the capital of the state of Jalisco and second city of the Republic. The line between Guaymas and Culiacan, a distance of 340 miles, has been completed and is in operation; since the first of August a through daily passenger and Pullman service has been maintained between Culiacan and Tucson, Ariz., a distance of 750 miles.

The length of the line between Culiacan and Mazatlan is about 150 miles. The construction of this section is being pushed rapidly with large forces from each end and the section will be completed and placed in operation early in January, 1909, when a through daily passenger and Pullman service will be inaugurated from Tucson to Mazatlan, a distance of 900 miles. From Mazatlan to Guadalajara the length of the line will be about 360 miles. The construction of this section is now in progress from Mazatlan south and also from Guadalajara north and the work at each end is being pushed with all the despatch consistent with economic construction. By the terms of the concession the entire line must be completed by November 6, 1912. The concession for the line south of Navojoa was granted directly to the Southern Pacific Company. All the other lines are being built under concessions granted to the Cananea, Yaqui River & Pacific Railroad Company, a Mexican corporation owned and controlled by the Southern Pacific Company.

BRANCH LINES.

The concession to the Southern Pacific authorizes the construction of as many branches on either side of the trunk line from Navojoa to Guadalajara (each branch not to exceed 150 kilometers in length) as may be desired. The branches desired may de designated at any time prior to the sixth day of November, 1915. No concession for the construction of parallel lines within a zone of 30 kilometers on each side of the line can be granted to any other company prior to November 6, 1920.

Alamos Branch.—This branch in reality extends from Corral via Navojoa to Alamos, a distance of 91.84 miles, for the reason that it was built under one of the Cananea, Yaqui River & Pacific concessions. In the practical operation of the lines, however, the part between Corral and Navojoa is regarded as the main line of the system, so that the Alamo branch proper begins at Navojoa and its length is only 36 miles. This branch has been in operation since the first of the year. Alamos is a beautiful and picturesque city, situated in the foot hills of the Sierra Madre mountains, the center of

Protection from Insects in the Engineers' Camp.

a rich and extensive mining and agricultural territory, with freight and passenger traffic to make this line an important feeder.

Yaqui River Branch.—This branch diverges from the main line at Corral, 69 miles east of Empalme. The line from Empalme to Corral was built under the concession of the Cananea, Yaqui River & Pacific Company, so that the portion of the main line between these points is a part of this branch. From Corral the road proceeds in a northeasterly direction following the Yaqui river, passing through Buena Vista, Cumuripa, Tonichi and several other towns of considerable importance, to the junction of the Yaqui and Bavispe rivers, thence with the courses of the Bavispe and San Bernardino rivers to a point on the international boundary near Douglas,

Ariz. This road will penetrate the heart of the region characterized by Baron Humboldt as "the mineral storehouse of the world." Heretofore the development of this section has been retarded on account of the lack of transportation facilities and the presence therein of bands of Yaqui Indians. The new railway will furnish the needed transportation facilities; and experience teaches that Indians are never a menace after the coming of the railway. This branch is destined to become one of the largest carriers of ore metal and mining machinery and supplies on the continent. It is completed to a point 20 miles north of Cumuripa, and 51 miles north of the junction with the main line at Corral. Construction is being pushed with a large force north of this point. Under the concession this line must be completed to the international boundary by May 11, 1914. Its length from Corral to the boundary is 388

Tracklaying Gang at Work.

miles. From Tonichi a short branch of 4½ miles will be built to the coal fields of Barranca.

Nacozari Branch.—This line leaves the Yaqui river line at its junction with the Moctezuma river and follows the Moctezuma, passing through the towns of Moctezuma, La Junta and Cumpas to its terminus at Nacozari. At Nacozari a connection will be made with the tracks of the Nacozari Railroad, a branch line of the El Paso & Southwestern extending from Douglas, Ariz., to Nacozari. The mineral deposits of the territory tributary to this line are known to be extensive, some of the ores being so rich that they are now transported by pack trains distances as great as 90 miles and shipped to the Douglas smelter, yielding handsome profits, despite the expense of this primitive method of transportation. The Pilares mine at Nacozari contains one of the largest deposits of low-grade sulphide copper ore in the world, and a new concentrator of 2,000 tons daily capacity has just been completed at Nacozari by the Moctezuma Copper Company for treating this ore. Construction work on this branch was begun at Nacozari, where a large tract of land has been secured for depots, warehouses, roundhouse, shops, yards and terminals. Its length is 111 miles. The concession requires its construction to be completed by May 11, 1914.

Nogales-Cananea Branch.—This 75-mile branch leaves the main line at Lomas, a station on the Sonora Railway two miles south of the international boundary at Nogales. It parallels the boundary line between Arizona and Sonora, following the beautiful valley of the Santa Cruz river, and terminates at a connection with the Cananea-Naco line at Del Rio, seven miles north of Cananea. It will be finished and put in operation by the middle of December. In addition to the considerable local traffic which this line will develop, its construction is of great importance, because it gives a western outlet and continuous line to the traffic Cananea.

Cananea-Naco Branch.—This line has been in operation for several years. It is 39 miles long, and extends from the great mining camp of Cananea to the international boundary at Naco, where it connects with the main line of the El Paso & Southwestern from Benson to El Paso. The revenues of this line from the transportation of the output of the copper mines, and from the volume of freight and passenger traffic incident to the operations which have been conducted on so grand a scale at Cananea, have been large.

ENGINEERING FEATURES.

All the lines built or under construction will compose a system of 1,785 miles. From the standpoint of construction, this mileage may be divided as follows:

	Miles.
Cananea, Yaqui River & Pacific R. R. Co.'s concessions.	781
Southern Pacific Company's concession	741
Sonora Railway Company (reconstruction)	263
Total	1,785

The maximum grades and curvatures are as follows:

Main Line.—From Empalme to Navojoa, 122 miles, the maximum grade is 0.5 per cent. and the maximum curve 3 deg. metric (chord of 20 meters; 4 deg. 34 min. with chord of 100 ft.). Large rivers crossed are the Yaqui and Mayo.

From Navojoa to Culiacan, 219 miles, the maximum grade is 0.5 per cent. and the maximum curve 4 deg. metric (chord of 20 meters; 6 deg. 6 min. with chord of 100 ft.). An average force of 2,000 men and 1,500 head of stock was used in grading, bridging and track-laying. Large rivers crossed are the Fuerte, Sinaloa and Culiacan.

From Culiacan to Mazatlan, 140 miles, the maximum grade is 0.5 per cent. and the maximum curve 3 deg. metric (4 deg. 35 min. with chord of 100 ft.). An average force of 700 men and 500 head of stock was used in grading, bridging and tracklaying. Large rivers crossed are the San Lorenzo, Elota and Piaxtla.

From Mazatlan to Tepic is 188 miles. The maximum grade from Mazatlan to the Santiago, 158 miles, will be 0.4 per cent.

Roberts' Tracklaying Machine at Work.

and the maximum curve 6 deg. metric (9 deg. 0 min. with chord of 100 ft.). From Santiago river to Tepic the maximum grade will be about 2 per cent. Large rivers crossed are the Presidio, Rosario and Santiago.

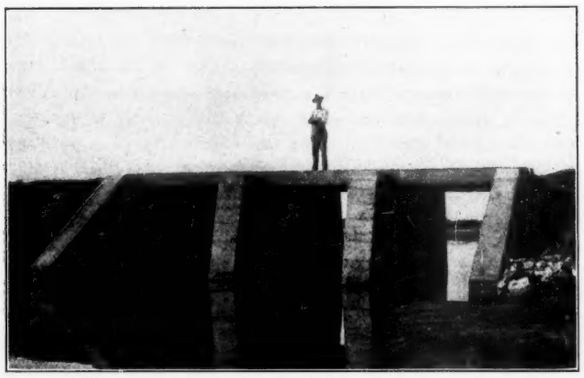
From Tepic to Guadalajara is 180 miles. Definite location of this section is now in progress, but the maximum grade has not been determined. During the past year an average force of 1,200 men and 50 head of stock has been employed in grading and bridging north of Guadalajara.

Alamos Branch.—From Navojoa to Alamos, 36 miles. Maximum grade 2.8 per cent., maximum curve 6 deg. metric (9 deg. 9 min. with chord of 100 ft.).

Yaqui River Branch.—From Corral to the international boundary, 388 miles. Maximum grade 0.5 per cent., maximum curve 6 deg. metric. During the past year an average force of 500 men and 400 head of stock has been used in grading, bridging and track-laying on this branch.

Nacozari Branch.—From Nacozari to mouth of Moctezuma river, 111 miles. Maximum grade 1.5 per cent., maximum curve 12 deg. metric (18 deg. 17 min. with chord of 100 ft.). An average grading force of approximately 300 men and 50 head of stock has been used on this work during the past year. The first 20 kilometers of this line is heavy canyon work along the Moctezuma river.

Lomas-Del Rio Branch.—From Lomas Station on the Sonora



Type of Concrete Bridge Used.

Railway to Del Rio, a distance of 75 miles. Maximum grade 2.6 per cent., maximum curve 6 deg. metric. During the present year 800 men and 400 head of stock have been employed in grading, bridging and track-laying on this branch.

Naco-Cananea Branch.—From the international boundary at Naco to Cananea, 39 miles. Maximum grade 2.45 per cent., maximum curve 5 deg. 15 min. metric (8 deg. with chord of 100 ft.).

TRAFFIC FEATURES.

Mention has been made of the mineral resources of the territory traversed by these lines. A large tonnage of ocean freight will be handled from Guaymas, the port furthest north on the mainland of the Gulf of California, and from Mazatlan, which is at the confluence of the gulf with the Pacific Ocean. The latter, by reason of its geographic position, is the most convenient port on the west coast of America for the immense cargoes carried by the "trade wind" vessels plying between America and India, China, the Philippines and the Hawaiian Islands. All of this ocean freight is now carried 2,000 miles north to San Francisco. Upon the completion of the line to Mazatlan this will become the port of discharge and their cargoes will be carried by the railroad to Guadalajara, Mexico City and other points in Mexico, and by fast freight north to the United States and Canada. The traffic from Mazatlan to Guadalajara and the City of Mexico is sure to be very large because this route affords the best approach to these two great cities from any point on the Pacific.

It goes without saying that the through freight and passenger traffic upon a direct line connecting two such cities as Guadalajara and Mexico City with Los Angeles, San Francisco and the Pacific coast of the United States will be heavy. Mexico City, like the tomb of Mohammed to the Mussulman, is the Mecca of all Mexicans, and the map shows an immense territory in Sonora and Northern Sinaloa, whose inhabitants can now reach the capital only by the circuitous route to Benson, Ariz., thence to El Paso, and from there over the Mexican Central to the City of Mexico. All this traffic will be diverted to the new line and its volume will be multiplied many times with the shortening of the distance and the increased facilities which will be afforded. The freight traffic which the country will furnish will be large in volume and will consist of live stock of all kinds, and a great variety of agricultural products, fruits, vegetables and timber. Among the agricultural products may be enumerated corn, beans, garbanzos (peas), sugar (crude and refined), alfalfa, sorghum cane (used as a forage for live stock), and agave, from which a fiber that is the highest-priced in the market is extracted. The fruits are of the finest quality and consist of the orange, banana, lemon, mango, chirimoya (known as vegetable ice cream), cocoanut, date, aguate, papaya (an appetizing breakfast fruit similar to the cantaloupe and from which is extracted the purest form of pepsin known), zepete, plum, strawberry, blackberry, melon, and in the mountainous sections the apple, peach and pear. The fruits which have been the source of such wealth to California are indigenous to the soil of the west coast of Mexico and are ready for market months in advance of the California product. The oranges grown in Sonora are the sweetest and have the most delicious flavor of any grown in America, with the possible exception of those of the Salt river valley in Arizona. The state of Sinaloa presents exceptional opportunities to the truck-gardener for raising winter fruits and vegetables. These can be produced there for the markets of the United States at a season when they cannot be supplied from any other section. Most fruits and vegetables may be grown there every month of the year.

The forests along the coast contain fine specimens of mahogany, ebony, maple, rosewood, lignum vitae, mora, willow and many other varieties of beautiful and valuable trees. In the hills and mountains are found the sycamore, cypress, spruce, pine, madroña, elm, walnut, cedar and oak, all similar to these species found in the United States, and in addition about 175 varieties of trees never seen in the forests north of this section.

The lands along the coast are for the most part covered with a dense growth of trees and underbrush and some grass, though the latter is not abundant. It is claimed that the forage from this underbrush will support more live stock to the same area than the famous bunch grass of the Northwest region. In the foot hills of the Sierra Madre range are magnificent grazing lands where conditions for stock breeding are ideal and the climate unsurpassed.

ELECTRIFICATION OF MELBOURNE SUBURBAN LINES.*

BY CHARLES H. MERZ, M.INST.C.E.

VIII.

Though gas engines might be considered for dealing with a load which resulted in a much better load factor on the station, say 70 per cent. to 100 per cent., and which had not the same momentary variations, they could not, on account of the absence of overload capacity, deal with a load such as that now under consideration without very excessive capital expenditure. This is the position to-day and is likely to remain the position for some considerable time. In saying this I have fully in mind the possibility of saving and disposing of the by-products if gas were utilized.

It is important when working with steam turbines to use superheated steam, and I recommend that the steam should be generated at a pressure of 200 lb. per square inch above atmospheric pressure and superheated to a temperature of 300 degrees centigrade. For generating this steam I recommend the use of water-tube boilers as, with this type of boiler, superheaters can be very conveniently arranged, and they have the following further advantages:—

(1) They are very adaptable to constant changes of load on account of their quick steam-rising properties.

(2) They allow of the construction of large combustion chambers, such as are necessary to deal economically with brown coal.

(3) They can be fitted with chain-grate stokers, which are

*Abstract of the Report to the Victorian Railways Commissioners on the application of Electric Traction to the Melbourne Suburban Railway System. Published by the courtesy of the commissioners.

the most reliable and efficient stokers for the conditions under consideration.

(4) The boilers are easily kept clean and the repair bill is a minimum.

I have devoted considerable thought and attention to the question of burning brown coal, if and when this should be available, and the specification for boiler plant specially provides for this. In addition to providing specially large combustion chambers and grate area, I propose to utilize induced draught, the fans being specified to produce a difference of pressure equal to one inch of water at the boiler dampers.

In designing the Yarraville power station I have taken into account not only the power required for traction purposes, but also that required for the Newport workshops, station lighting, etc. The accompanying table gives the more important technical details for each of the four stages.

The station is designed to deliver electrical energy as three-phase current at a periodicity of 25 complete cycles per second and at a voltage between phases of 12,000 volts. The voltage is chosen because it is the highest voltage for which I can recommend that turbo-generators should be wound and because it is sufficiently high for economically transmitting the electrical energy the necessary distance to the several sub-stations. A periodicity of 25 complete cycles per second is chosen as the most adaptable for any general developments likely to take place. It is also the most suitable for the operation of 800-volt rotary converters.

Technical Details of Plant in Proposed Power Station at Yarraville.

Generating Plant.	Port Melbourne and St. Kilda branches.	Stage I.	Stage II.	Stage III.
No. of generating sets installed.	3	4	6	8
Normal continuous capacity of each set, in E.H.P.*	5,000	5,000	5,000	5,000
Capacity of each set for 2 hrs., in E. H. P.*	6,000	6,000	6,000	6,000
Number of spare sets	2	2	2	2
Number of sets working at peak	1	2	4	6
Overload capacity, during peak in E. H. P.	6,000	12,000	24,000	36,000
Maximum load to be dealt with in E. H. P.	3,480	12,000	22,100	35,000
Boiler House Plant.				
Continuous steaming capacity of boilers installed in lbs. of steam per hour.	80,000	200,000	320,000	480,000
Approximate percentage of spare boilers allowed for cleaning and repairs, per cent.	25	25	19	17
Continuous steaming capacity of boilers working in lbs. of steam per hour	60,000	150,000	260,000	400,000
Peak steaming capacity of boilers working in lbs. of steam per hour.	75,000	188,000	325,000	500,000

*The actual outputs specified for (Specification No. 2) allow a margin on these figures for low power factor and abnormal working conditions.

The following is a general description of the proposed plant and its arrangement:

Buildings.—The buildings will be steel-framed structures carried on concrete foundations. The engine room is designed to entail the minimum amount of labor in operation and to admit of all machinery being kept in view and accessible to the overhead crane.

The coal, after being unloaded from a steamer at the station wharf, or from the railway trucks, as the case may be, will be delivered to coal bunkers situated above the boilers, by automatic coal conveying gear.

Generating Units.—The engine room will contain turbo-generators of the Parsons, Curtis, or other type, depending on the tenders received, and the steam will be exhausted from them into condensers arranged with suitable circulating and air pumps capable of maintaining the highest vacuum commercially possible. The capacity of each turbo-generator will be 6,000 h.p.* This size of turbo-generator is chosen because it is about the maximum size of alternator that can be conveniently built for 1,500 revolutions, the highest speed for which a 25-cycle generator can be built, and, with steam turbines, the higher the speed the better is the economy.

*The size of generator is really too large if you were to consider dealing with the Port Melbourne and St. Kilda branches only, as only one would be working out of three provided (three are necessary to allow two units spare). On the other hand, a smaller size would not be so economical and would not be the best size when the station came to be extended.

To deal with the lines covered by Stage I, the station will contain four generating sets, two of which will easily be able to deal with the load, thus allowing two generating sets as spare. It can, however, be readily extended as may be required from time to time, though the intention is that it should not be extended beyond a total of 10 units, this being the greatest number of units that can, in my opinion, be advantageously operated in one power station. When this number is reached it may, in general, be taken that it is better to commence a second station entirely distinct from the first. From the chart already referred to, it will be seen that the maximum peak load, even if all the lines be converted to electric traction, is estimated to amount to about 35,000 h.p.. Six of the above turbo-generator units would, therefore, be capable of dealing with this load, and assuming two units spare, we obtain a total of eight units as the equipment of a station to deal with the requirements of the whole of the suburban railways on present estimates. This allows two additional units, without extending the station beyond what it was originally designed for.

Boiler-house Equipment.—The boilers will be of the water-tube type and will deliver steam at a pressure of 200 lbs. per square inch above the atmosphere and superheated to 300 degrees centigrade. The coal will be fed into mechanical stokers by gravity, the stokers being specially designed to burn the coal with a maximum of economy and smokelessly. The ashes will be raised by special hoists into the bunkers provided for the purpose.

Switch-house.—The switch-gear will be situated in a special switch-house, where there will also be a control-room, from which all the generators and the feeders going out of the power station will be controlled. This control-room will be connected by telephone with the engine-room, the boiler house, and the various sub-stations.

Operation Offices.—The necessary operation offices are provided in a part of the switch-house building.

The technical details of the proposed plant are dealt with fully by the specifications presented with this report. The specifications suggested to cover the construction of the power station are:

(1) Steel work for engine and boiler-house, including the complete boiler-house equipment, piping, coal and ash handling gear and overhead traveler (specification No. 1).

(2) Turbo-alternators and condensing plant (specification No. 2).

(3) Switch-gear, control panels, motor generators, auxiliary motors, main wiring and lighting (specification No. 3).

(4) Foundations, jetty, sidings and auxiliary buildings (specification No. 4).

It is impossible to draft specification No. 4 or draw detailed plans for these works until the type of plant under specifications Nos. 1, 2 and 3 has been definitely decided on. For instance, the specification for the boiler-house equipment leaves the actual number of boilers open, so that a manufacturer may quote for either a smaller number of large boilers or a larger number of small boilers, always providing the steaming capacity required is obtained, with the necessary spare plant. This allows manufacturers to quote on their standard apparatus. Further, some turbo-generators are arranged with vertical shafts and others with horizontal shafts, and this affects the design of foundation. The specification is specially arranged to cover either type of plant in order that you may be free to accept the most satisfactory proposition, taking everything into consideration.

(*To be continued.*)

WILLIAM H. NEWMAN'S CAREER.

Mr. Newman's effectiveness began 25 years ago, when he was appointed traffic manager of the Missouri Pacific. In those days he had distinctly the Southern and Southwestern flavor. Not much given to talk, he had the quality of concentration to an unusual degree. He would approach his subject first from one point in a tentative way and feel his ground as he advanced. No man was quicker to discern the strength of opposition and none more ready to turn the subject and reorganize his forces for another line of approach, but he was tenacious to the last degree in pushing the object of the chase and would frequently tire out his opponents and make his point by nominal concessions and the clever adoption of alternatives. He then seemed to be the strongest man in the traffic field, and in due time came into the Chicago and North Western organization, of which the Omaha Company was a part.

In Marvin Hughitt he found a man of qualities differing widely from those with whom he had been associated. Clean cut, positive, diplomatic, exacting, but helpful and considerate to those associated with him. It was his experience with Mr. Hughitt that served to smooth a certain rough edge sometimes in evidence in Newman's business manner and it taught him to practice a little more of the diplomatic method, but did not in the least detract from his strong points.

Newman never seemed to take into consideration what the other fellow thought about anything. The mistaken policy of finding out the opinion of his superior before having one for himself was not his way. In conference with his superiors he would give his opinions and reasons with as much freedom and back them up with as much confidence as with a subordinate, but if authoritatively overruled he would carry out the policy dictated.

When he came to the Great Northern Railway as Vice-President in charge of traffic he met an entirely new situation and had to deal with new conditions and a policy in some respects greatly at variance with that prevailing on the North Western. Until then Mr. Hill had few, if any, men who dared to express adverse opinions. It is tolerably certain that none such was expressed without danger to its holder. Mr. Newman came into the camp and took his stand with reference to questions concerning policy and details of traffic matters in that turbulent quarter apparently quite unconscious of Mr. Hill's precedents.

With his keen insight into character and watchfulness of results, Hill soon discovered that this man's judgment was worthy of respect and it was soon evident to those in daily contact with him that Newman's ideas were not infrequently but unconsciously adopted as his own. I do not believe that Newman ever dodged an issue with Hill. His common sense, placid courage and utter disregard for anything like playing policy doubtless gave to Hill a new sensation, won his confidence, and when Newman left the road to go to the Lake Shore he designated his successor in W. W. Finley, the friend who had been his companion in the southwest and who is now president of the Southern Railway.

It well may be that Mr. Newman leaves the service with mixed feelings. When he came to New York, more than seven years ago, he had, apparently, the chance of a lifetime to round out his career by pushing the New York Central again to the foremost place among the railways of the world. Fortune, the fortune that he wanted, knocked at his door, for Mr. Callaway in his brief term had barely pointed the way out, and Mr. Newman had the knowledge and the qualifications for doing the work. It would have been difficult to find a better traffic officer. In his service under such autocrats as Marvin Hughitt and James J. Hill, he had shown dogged persistency and diplomatic skill in carrying out his plans, after repeated refusals to approve them. On the Missouri Pacific and on the Lake Shore he had shown administrative capacity and the peculiar quality which we call a knowledge of men. He rarely made a mistake in choosing members of his staff, and he organized the New York Central on the lines indicated by Mr. Callaway.

It is probably unfortunate that the organization is primarily departmental, instead of divisional, but this was only a minor cause for the failure to maintain any consistent policy in developing the territory and perfecting the transportation machine for doing its work economically and in a way most satisfactory to the public. Unquestionably he was so qualified if he had been aided and supported by a competent board of directors. He would probably have succeeded fully, instead of partially, if he had been unhampered.

The board had always been well balanced in respect of members capable of giving the best financial advice, with the result of really skillful financial management and high credit. A list of the remaining members constitutes a humorous paragraph. The reader needs no commentator; it is concentrated absurdity. A weak board is not simply a negative defect in the organization. Its power for mischief is shown in such purchases as the burdensome Boston & Albany and the relief of members of the family by buying in their bad investments.

Unwise, as some of these undertakings have been, their losses have been quickly measurable in money, and are not to be compared with the injury done to the company by a consistent policy of inaction until driven to it in cowardly fashion by public clamor. This is traditional. The Central was nearly the last important company to apply the life-saving air brake to its trains. The New Hamburg disaster to an unbraked train raised such a riot of indignation that the directors, cowering with fear of indictment for manslaughter, made the quickest known application of power brakes to its entire passenger stock. Similar incidents, such as the great tunnel collision, are still fresh in the memory of newspaper readers. On this road, accidents with great loss of life, and resulting public remonstrance, have been the causes for improvements. Foresight and plans by the officers have been ignored until they were emphasized by killings and threats.

But these are not the only injurious effects of a weak board of directors. With a considerable proportion of members physically incompetent, mentally unfit, or largely non-resident, or inattentive, there is left room for the whimsical, or mischief-making, member to acquire and exercise the power of veto and interference. This we have had, and probably no one saw it earlier, and found it to be an impasse, than did Mr. Newman. Why did he not then resign and put the responsibility where it belonged? Probably because of the pronounced dogged element in his character, and a cheerful poise which no worry ever affects, combined with the knowledge that he was making substantial, although unsteady, progress such as another might not be able to make under absurd directorial control.

A railway needs a one-man government. Heads of departments should be specialists. The ideal president is a fully informed man of broad perspective, who can bring to bear on one detail the whole weight of his diversified knowledge, so that there will be no blunders resulting from one department's not properly allowing for the effect of its actions on other departments. President Newman had the qualifications for this work. He gave the man at the head of each department full authority, but he also kept his own finger on the machine. He was always ready in conference and advice, and had the faculty of bringing out all sides of a question, and clarifying and broadening a man's ideas. A subordinate who came to him with a problem which he had studied out was liable to be met with the statement: "You're all wrong." But it was said in a cheerful fashion, calculated to put the man on his mettle so as to encourage a strong argument defending his position.

He carried in his mind the geographical and strategic traffic position of almost every road in the country. In other than traffic matters, however, he had to make close studies as

problems arose. In doing so, he went into detail and learned all about it, but without losing his perspective. When it became necessary to electrify the New York terminal he appointed a commission and studied all sides of the question. This study was so complete that when it was finished he had a concrete problem to submit to experts for estimates, etc., leaving no loose ends to complicate things after the experts had made their report.

President Newman's retirement from railway service is not alone a loss to the New York Central lines. He exerted wide influence in directing the general railway policy of the country.

PENNSYLVANIA RAIL RECORD BLANKS.

The Pennsylvania rail committee has prepared the blanks shown in the accompanying cuts for keeping a record of rail failures. In reproducing these blanks, they have been in most cases condensed. In the actual sheets for dividing statistics according to the individual manufacturers, for example, there are spaces headed by the names of a number of different makers, while we show only one or two.

These blanks are divided into four groups. The first group shows information obtained at the mills during the process of manufacture. Of these, the first is the report of chemical and physical examination. This combines in one blank information regarding the particulars of rolling, chemistry, drop test, percentage of crop from the ingot, and shrinkage allowance at the saws. The carbon content is determined for every heat; and the other constituents as provided for in the specifications. The next is the certificate of inspection, which is a certificate to the railway company that the rails which have been accepted conform to the specifications. It gives also a statement of the rails that have been rejected and the reasons therefor. The third, which is the report of shipment, we have not reproduced. This blank has spaces to be filled out with data showing the kind of rail, weight, section, manufacturer, consignee, order number, etc., and below is a table in which is designated the number of each car, the number of rails of each length, total rails, and shippers' rates in pounds. One copy of this report goes to the Chief Engineer, and two copies to the General Superintendent, one of which is for the Division Superintendent. It is sent by the inspector. The fourth blank is a laboratory report of examinations of special rail; it may also be used for reporting check, analyses against the mill analyses.

The second group consists of those relating to rail statistics which are sent in by division officers. They are entirely distinct from those used by the accounting department. The first of these is the report of rail failures in main track. On this blank are recorded the complete particulars of the rail that has failed, so far as its location and the known physical conditions surrounding it are concerned. On the back of the blank a classification or description of rail failures has been placed, so that the failures may be grouped together for intelligent study. This form has been adopted by the American Railway Engineering and Maintenance of Way Association, as form M.W. 1,200. The next is the superintendent's monthly report of rail failures in main tracks. This is to be filled out once a month from the preceding form. On it the information obtained from the original reports is concentrated, and on the back of it is data similar to that on the preceding blank. The third is a statement of rails existing in main tracks. This is an annual statement to be made by the engineer in charge of each division, showing the different kinds of rail in the main track at the end of the year.

The third group consists of blanks for statistical compilations of rail failures for purposes of study. There are four forms in this group and they are intended to be kept together. The first is not reproduced herewith. It is a cover enclosing the other three forms, and when filled out tells the division and year to which the enclosed blanks refer. The other three

M. W. 940

PENNSYLVANIA RAILROAD COMPANY

PHILADELPHIA, BALTIMORE & WASHINGTON RAILROAD COMPANY
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY

REPORT OF CHEMICAL AND PHYSICAL EXAMINATION

Sheet No. ____ of ____ Sheets

of ____ Rails ____ Process ____ lbs. per yard ____ Section
Manufactured by ____ Steel Co., at ____ Works
For ____
Order No. ____ Date of Report ____ 19
No. of Passes in Rolls ____ Bar held on average of ____ seconds at ____ Pass
Shrinkage allowance at Saws ____ Inches on 33-foot rails.
Distance between supports on Straightening Press ____
Weight of Tup ____ lbs. Height of Drop ____ feet. Distance between Supports, 3 feet
Average Number of Rails per Heat ____

HEAT No.	PERCENTAGE OF DROP FROM INGOT			CARBON	MANGANESE	PHOSPHORUS	SILICON	SULPHUR			DROP TEST FINAL DEFLECTION INCHES	REMARKS
	No. of Ingots	% from Top	% from Bottom									

INSTRUCTIONS
One copy of this report to be forwarded to the Chief Engineer.

Correct: ____ Inspector
Approved ____ Chief Inspector

Chemical and Physical Examination.

M. W. 942

PENNSYLVANIA RAILROAD COMPANY
P. B. & W. R. R. N. C. RY. W. J. & S. R. R.

CERTIFICATE OF INSPECTION

Of ____ Process Rails ____ lbs. per yd. ____ Section.
Manufactured by ____ Steel Co. at ____ Works
For ____

Mr. ____ Chief Engineer. Date ____ 19____

The following Steel Rails have been inspected and accepted according to contract

Rails are certified to be within the limits of the Specifications of the ____

and approved as per details given below:

All Rails have been inspected and approved for Chemical Analysis, Physical Tests, Section, Weight, Straightening, Drilling, Sawing, Length, Stamping, Finish, Quality.

All Rails are marked on the web with maker's name, date of manufacture, heat number, and position occupied in the ingot. Date of rolling ____

No. of Rails rolled ____ No. of Rails accepted ____

No. of Rails temporarily rejected and cause ____

No. of Rails condemned and cause ____

This Certificate covers the run from Heat No. ____ to Heat No. ____ both inclusive.

NUMBER OF RAILS OF EACH LENGTH								
Length	33	30	27½	25	Total
Number					

CALCULATED WEIGHT			SHIPPER'S SCALE WEIGHTS		
TOTAL POUNDS	TONS	POUNDS	TOTAL POUNDS	TONS	POUNDS

Amount accepted under this Certificate ____
Total amount of Order ____
Balance due on Order ____

TRIAL WEIGHTS			
HOURS	WTS.	HOURS	WTS.
6A		6P	
7"		7"	
8"		8"	
9"		9"	
10"		10"	
11"		11"	
12M		12M	
1P		1A	
2"		2"	
3"		3"	
4"		4"	
5"		5"	

INSTRUCTIONS.
One copy of this Certificate is to be made out and forwarded to the Chief Engineer.

Correct: ____ Inspector.
Approved: ____ Chief Inspector

Certificate of Inspection.

M. W. 947
Report No. ____

PENNSYLVANIA RAILROAD COMPANY
P. B. & W. R. R. W. J. & S. R. R.

Laboratory Report of Chemical and Physical Examination of Rail and Other Track Material

Referred to in ____
Laboratory No. ____ Sample represents ____
Place and Date ____ 19

CHEMICAL ANALYSIS											PHYSICAL TEST					
LOCATION OF BORINGS	C	Mn	P	Si	S						TENSILE STRENGTH	ELASTIC LIMIT	ELONG. IN in.			

LOCATION OF BORINGS — Remarks

Laboratory Examination of Special Rail.

M. W. 34 — 8 x 10½ Copying Ink

PENNSYLVANIA RAILROAD COMPANY
P., B. & W. R. R. N. C. RY. W. J. & S. R. R.

_____ Division

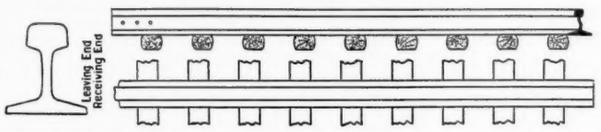
REPORT OF RAIL FAILURES IN MAIN TRACKS

Section No._____ Date of Report_____19__

1 Original Weight per yard_____lbs.
2 Rail Section_____
3 Brand on Rail_____
4 Heat No. on Rail_____
5 Letter on Rail_____
6 Length of Rail_____
7 Location_____ft._____of Mile Post_____
8 Which Track?_____
9 On Curve or Straight Line?_____
10 High or Low Rail, if on Curve?_____
11 State Degree of Curve_____
12 Superelevation of Curve at break_____
13 Were Tie Plates used?_____If so, what kind_____
14 Month and Year Rail was laid_____
15 Was Rail Broken, Defective, or Damaged?_____
16 Date and Time found_____

17 Was Rail Removed or Spliced?_____
18 If Removed, give date_____
19 State exact gauge of Track at break_____
20 Was Rail much or little worn?_____
21 Was Break over or between Ties?_____
22 Was Break square or angular?_____
23 Distance, center to center of ties on each side of Break_____
24 Condition of Ties each side of Break_____
25 Condition of Line and Surface_____
26 State kind of Ballast_____
27 Was Track properly ballasted?_____
28 State kind of material under ballast_____
29 Was Track well drained?_____
30 Was Roadbed frozen?_____

31 Condition of Weather (wet, dry, warm or cold, freezing or thawing)_____
32 If Break was at Splice, state name of splice, number of holes, and whether it was full bolted or insulated._____
33 If accident or detention of trains was caused by break, state circumstances._____
34 If damaged, describe nature and cause, if known. (See instructions on back)_____
35 If defective, describe location of flaws or defects, and, if possible, what caused them. (See back of Report for description of failures.)_____
36 Draw on diagram Lines of Break, or partial fracture, such as long pieces from side of head, and half moon pieces from base, showing dimensions. Hollows in head should be shown on end section. Defects may also be indicated on diagram. Mark distance from end to break. If break is nearest "Receiving End" draw pen through words "Leaving End." If nearest "Leaving End," draw pen through words "Receiving End."



37 State cause of breakage as near as you can._____

Approved: Correct:

_____Supervisor _____Foreman

INSTRUCTIONS AND DESCRIPTION OF FAILURES ON BACK

Failures in Main Tracks.

INSTRUCTIONS

A The Foreman will send this report to the Supervisor the same day the break is discovered and in the case of a damaged or defective rail, the day it is taken out of the track.

B The Supervisor will forward this report direct to the Engineer M. W. and a copy to the Assistant Engineer

C Mile Post number from { South / East } end of Division to be used.

D The "Letter" in 5 (front page) will be found a few inches to the right of the Heat Number

E The _____will have copies of this report made immediately upon receipt and send a copy to each of the following officers:_____

DESCRIPTION OF RAIL FAILURES

When describing Failures of Rails, the following terms should be used:

1 BROKEN RAIL. This term is to be confined to a rail which is broken through, separating it into two or more parts. A crack which might result in a complete break will come under this head.

2 DAMAGED. Under this head will be included all rails broken or injured by wrecks, broken wheels or similar causes.

3 FLOW OF METAL. This term means a "Rolling out" of the metal on top of the head towards its sides without there being any indication of a breaking down of the head structure; that is, the under side of the head is not distorted.

4 CRUSHED HEAD. This term is used to indicate a "Flattening" of the head and is usually accompanied by a crushing down of the head as shown in the sketch.

5 SPLIT HEAD. This term includes rails split through or near the center line of the head or rails with pieces split off the side of the head. When this term is used, it should be further defined by stating whether it is or is not accompanied by a seam or hollow head.

6 SPLIT WEB. This term is a longitudinal split along the axis of web generally starting from the end of rail through the bolt holes.

7 BROKEN BASE. This term covers all breaks in base of rail and should be described and illustrated on sketches on front page.

Reverse Side of Sheet Reporting Failures in Main Tracks.

INSTRUCTIONS

A. The Assistant Engineer will make out two copies of this report from the Section Foreman's reports and send them to the Superintendent who will forward one copy to the General Superintendent, and one copy to the Engineer M. W. not later than the 10th day of the following month.

B. Mile Post Number from { South / East } end of Division to be used.

C. The term "Main Tracks" is intended to cover all running tracks including third and fourth tracks used by freight trains, also passing sidings or other tracks used regularly by passenger trains.

DESCRIPTION OF RAIL FAILURES

1. BROKEN RAIL. This term is to be confined to a rail which is broken through, separating it into two or more parts. A crack which might result in a complete break will come under this head.
2. DAMAGED. Under this head will be included all rails broken or injured by wrecks, broken wheels and similar causes.
3. FLOW OF METAL. This term means a "Rolling out" of the metal on top of the head towards its sides, without there being any indication of a breaking down of the head structure; *i. e.*, the underside of the head is not distorted.
4. CRUSHED HEAD. This term is used to indicate a "Flattening" of the head and is usually accompanied by a crushing down of the head as shown in the sketch.

5. SPLIT HEAD. This term includes rails split through or near the center line of the head or rails with pieces split off the side of the head. When this term is used, it should be further defined by stating whether it is or is not accompanied by a seam or hollow head.
6. SPLIT WEB. This term is a longitudinal split along the axis of web generally starting from the end of rail through the bolt holes.
7. BROKEN BASE. This term covers all breaks in the base of rail.

Reverse Side of Superintendent's Monthly Report.

M. W. 34 B—Copy Ink
10½ x 8

Sheet No.____ of____Sheets

PENNSYLVANIA RAILROAD COMPANY
P., B. & W. R. R., N. C. RY., W. J. & S. R. R.

SUPERINTENDENT'S MONTHLY REPORT OF RAIL FAILURES IN MAIN TRACKS

*on the*_____*Division*_____ *FOR the Month of*_____*190*

DAY OF MONTH FOUND	LOCATION OF RAIL							DESCRIPTION OF RAIL							NATURE OF FAILURE							REMOVED OR SPLICED	TIME IN SERVICE WHEN FOUND	IN SPLICE	NOT IN SPLICE	STATE CAUSE OF FAILURE WHEN KNOWN, AND REMARK ON DEFECTS IN COLS. 16 to 22, INCL.
	MAIN LINE OR BRANCH NAME	MILE POST		Which Track	Curve or Tangent	Degree of Curve	Superelevation	Weight per Yard	Type of Section	Length	MARKS ON RAIL				Broken	Damaged	Flow of Metal	Crushed Head	Split Head	Split Web	Broken Base					
		No.									Manufacturer	Date Rolled	Heat No.	Letter												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Total Failures (Col. 10)																										Grand Total of Failures for Month (Col. 24.)

USE FOLLOWING MARKS FOR MAKING ENTRIES IN COLUMNS

In Col. 5, use E. B. P. for East Bound Passenger, etc.
In Col. 6, use T. for Tangent; I. C. for Inner Rail on Curve; O. C. for Outer Rail on Curve.
In Col. 16, 17, 18, 19, 20, 21, 22, 25 and 26, use figure "1" to designate proper column
In Col. 23, use R. for Removed and S. for Spliced and Left in Track.

CORRECT

_____Assistant Engineer

APPROVED

_____Superintendent

Superintendent's Monthly Report.

give, first, a summary of rail failures by years; second, a comparison of the number of failures of rails of different sections or patterns rolled by different companies; and, third, the position in the ingot of the rails which failed.

The fourth group of blanks is for reporting the actual measurements of rail sections laid in the track at stated periods, in order to determine the relative wear of rails of different composition and manufacture. The first of these forms is not reproduced herewith. It is a cover for enclosing the other forms in the group, and when filled out tells what

classes of rails are concerned and the dates they were laid and removed. There are two location diagrams of rails laid. The one shown here is on the scale 2 in. = 1 mile. This is a location diagram on a large scale for reporting a single group of a special kind of rail under observation. It is filled out with plans of track, curvature being indicated in the usual way, and also profiles, giving gradients. The locations of the rails in question are then indicated with respect to these diagrams. Different kinds of rail, Bessemer, open hearth, etc., may be shown in different colors. The other location diagram we have not reproduced. It is similar to the above, but on a scale 1 in. = 1 mile. It is filled out with a plan only, showing the location of all of a certain kind of rail that may have been sent out for trial. As many sheets as may be necessary are used. Except for the different scale, it is similar in form to the other blank. The next is a diagram illustrating wear. Each individual rail measurement made is recorded on this blank. Considerable trouble may be saved by printing on the blank the particular rail section that is being studied. The space under "scheme of marking lines of wear" is filled in with a key showing what color or kind of line illustrates the measurements taken on each date.

M. W. 841

PENNSYLVANIA RAILROAD COMPANY

PHILADELPHIA, BALTIMORE & WASHINGTON RAILROAD COMPANY
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY

Statement of Steel Rails existing in Main Tracks of _____ Division

_____ Main Track December 31, 19____

LOCATION				YEAR LAID	BRAND	WEIGHT PER YARD	Type of Section	LENGTH IN FEET OF TRACK			
FROM		TO						LAID PREVIOUS TO 19__	NEW STEEL LAID 19__	__STEEL LAID 19__	REMARKS
M.P.	+FL	M.P.	+FL					1	2	3	4

No. Ft. 60 lb. Rail_____ No Tons_____
" " 70 " " _____ " "
" " 85 " " _____ " "
" "100 " " _____ " "

Correct:

_____ Assistant Engineer

Approved:

_____ Superintendent

Column 3 to be used for any special rail, such as Re-rolled or Sawed and Re-drilled.
Two copies of this report to be made out and forwarded by the Assistant Engineer to the Superintendent, who will forward one copy to the General Superintendent and one copy to the Engineer M. of W. as soon after the close of the year as possible.

Annual Statement of Rails in Main Track.

M. W. 840

PENNSYLVANIA RAILROAD COMPANY

P., B. & W. R.R. N. C. RY. W. J. & S. R. R.

_____ System or Railroad

Comparative Number of Failures of Steel Rails of Different Section or Pattern, Rolled by Different Steel Companies

Record for Period Ending_____ 19____

Steel Company and Mill Where Rail was Rolled	Rail Weight per yd. lbs.	Rail Section or Pattern	No. of Tons of Rail Laid in Tracks	KIND OF FAILURES							AGGREGATE LENGTH AND WEIGHT OF RAILS WHICH FAILED	
				Broken	Flow of Metal	Crushed Head	Split or Piped	Split Web	Broken Base	Total	Total Weight in Tons	Percentage of Tons Laid
Carnegie Steel Co.												
Edgar Thompson Mill												

Failures Grouped According to Makers.

M. W. 34 D

692 J 10½ x 8 5-7-09

PENNSYLVANIA RAILROAD COMPANY

P., B. & W. R. R. N. C. RY. W. J. & S. R. R

_____ Division

SUMMARY OF RAIL FAILURES IN MAIN TRACKS

(COMPILED FROM M. W. FORM 34 A)

_____ lb. _____ Section, Rolled by _____ Steel Co. _____ Record for Period ending _____ 19____

	Year Laid	Tons of New Rail Laid	NUMBER OF RAILS WHICH HAVE FAILED EACH YEAR BELOW												Total	KIND OF FAILURES						AGGREGATE LENGTH AND WEIGHT OF RAIL WHICH FAILED		
			19	19	19	19	19	19	19	19	19	19	19	19		Broken	Flow of Metal	Crushed Head	Split or Piped	Split Web	Broken Base	Total Length in Feet	Total Weight in Tons	Percentage of Tons Laid
	19																							
	19																							
	19																							
	19																							
	19																							
	Totals																							

Note

Rails broken or injured by wrecks, broken wheels or similar causes, are not to be included in this report.

Summary of Rail Failures by Years.

M. W. 34 K

PENNSYLVANIA RAILROAD COMPANY

PHILADELPHIA, BALTIMORE & WASHINGTON RAILROAD COMPANY
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY

_____ DIVISION

POSITION IN INGOT OF STEEL RAILS WHICH FAILED Sheet No. _____

For Period of _____ ending _____ 19 of _____ Sheets

_____ Type of Rail Section

	KIND OF FAILURE	CARNEGIE STEEL COMPANY														ILLINOIS STEEL COMPANY													
		100-LB								85-LB.								100-LB.								85-LB.					
		A	B	C	D	E	F	Unknown	Total	A	B	C	D	E	F	Unknown	Total	A	B	C	D	E	F	Unknown	Total	A	B	C	D	E	F	Unknown	Total
	Broken																														
	Flow of Metal																														
	Crushed Head																														
	Split Head																														
	Split Web																														
	Broken Base																														
	Totals																														

NOTE: The letters A, B, C, etc., denote the position of the Rail in the Ingot, "A" being the top rail, "B" the second, etc.
The percentages which the record figures are of the total, are to be put above the record figures in the columns under A, B, C, etc.

Position in Ingot.

A=.....shown in Red. B=.....shown in Yellow.

Summary.

Month and Year												
Kind of Rail	A	B	A	B	A	B	A	B	A	B	A	B
Total sq. in. Wear												
Aver. sq. in. Wear per Section												
Increased Wear per cent.												

PENNSYLVANIA RAILROAD COMPANY

P. B. & W. R. R. N. C. RY. W. J. & S. R. R.

.....Div.

LOCATION DIAGRAM OF

.....Rails.

Laid in 19..... Removed in 19.....

Between.....and.....

Office of Engineer M. W.

Scale 2 in. = 1 m. Date.....

Location Diagram for Single Group of Special Kinds of Rail.

No. showing Location in Track.

Low or South Rail.

GAUGE

High or North Rail.

SCHEME OF MARKING LINES OF WEAR.

LOCATION DATA.

In E. or W. B. Pass. or Frt.? .....
Degree of curve? .....
E. end W. end or center of curve? .....
Superelevation of curve? .....
Speed for which elevated? .....
Tangent? .....
Kind of ballast? .....

MEASUREMENTS TAKEN AT RAIL CENTER

EXPERIMENTAL DATA.

Kind of Steel? .....
Weight per yard? .....
Section or Pattern? .....
Manufacturer. .....
Heat No. .....
Letter. .....
Laid. .....
Removed. .....

Measurements of Area Abraded.

Date of Measurement	Sq. in. abraded				
	Low Rail		High Rail		
	Area Abraded	Diff.	Area Abraded	Diff.	

PENNSYLVANIA RAILROAD COMPANY

P. B. & W. R. R. N. C. RY. W. J. & S. R. R.

.....Div.

DIAGRAM SHOWING LINES OF WEAR OF

.....Rails

Laid in 19..... Removed in 19.....

Between.....and.....

Office of Engineer M. W.

Scale full size Date.....

Diagram Showing Lines of Wear.

RAILROAD ACCOUNTING AND THE HEPBURN LAW.

BY ARTHUR C. GRAVES, M.A.
New Haven, Conn.

IV.

THE POWER TO PRESCRIBE ACCOUNTS.

This brings us now to the last provision of the Hepburn Act affecting railroad accounting, and this last, so sweeping in nature, seems to include all else in it. It is:

"The Commission may, in its discretion, prescribe the forms of any and all accounts, records and memoranda to be kept by the carriers * * * including the accounts, records and memoranda of the movement of traffic as well as the receipts and expenditures of money. The Commission shall have access at all times to all accounts," etc., "kept by carriers, and it shall be unlawful for such carriers to keep any other accounts," etc., "than those prescribed by the Commission."

In our presentation of this subject we have said in another connection that railroad accounting is a science that requires long service to understand its spirit and genius. It has grown up and developed side by side with railroad operation and management. It is under the presiding influence and oversight of the manager and operator that railroad accounting should be guided and controlled, according to such methods as are best adapted to his operating conditions. In no other business is the discretion of the manager and freedom of action so necessary. In no other business is the interference of the government in methods of bookkeeping and accounting so unnecessary and so little to be desired. Furthermore, there is no business in which accounting has so intimate a relation with operation, with economy and with managerial skill as in railroading. This is so because railroad companies in this country have such extensive operations, covering so many miles of lines, in so many states, and under such diversified geographical conditions that personal supervision and oversight over all operations are, of course, impossible. But in railroad management close scrutiny of the returns of all operations takes the place of personal operating supervision, and all returns and expenses of operation must pass under the examination of the management or some directing official in the form that he desires and can most readily understand, and also that comparisons with former results on the same division and results of corresponding operations on the other divisions of the road may be quickly made and read intelligently. The compilation and working up of statistical data is one of the utmost importance and absolutely necessary to efficient management. Hence it will be seen that for the government to dictate the books and accounts to be kept by the carrier must ultimately be destructive of economy, efficiency and skill in management. The interference of an outside party like the government in such an important detail of railroad management as the accounting must bring about a relaxing of discipline and finally demoralization in administration. The accounting department of a railroad has a larger force of employees than any other department of the general administration. Government dictation in railroad bookkeeping is destructive of personal ambition and all spirit of loyalty among railroad employees. It will be seen that in railroad accounting, so intimately connected as it is with railroad management, dictation by the government amounts to interference with the actual operation of the road which, of course, belongs to the railroad manager.

Marshall M. Kirkman, in Vol. X. of his series on "The Science of Railways," page 38, there lays down the principle which all students of railroad operation recognize as fundamental: "It is neither desirable or practicable for the government, or anyone else, to prescribe, except in a general way, what books a railroad company shall keep or the forms and methods that shall be observed. How the accounts shall be kept, how the amount of their earnings shall be summed up, * * * or otherwise, are not matters about which anyone need concern himself. Owners will look after them and more wisely than anyone lese because they are more directly affected than anyone else. To define what books shall be kept and what forms shall be observed in writing up accounts is to deaden, to destroy, in fact, the interest felt in the subject by the thousands of intelligent and progressive men employed in this department of the service, and, in doing so, deprive the corporations of the invention and introduction of better and more economical methods from time to time that the study and experience of their employees would otherwise suggest. It would be quite as sensible and practicable to seek to restrict the ingenuity and interest of men in other branches of business."

In relation to railroad publicity of accounting we have shown that of all corporations, or of all industries, in this country those that the least require a paternal oversight on the part of the government to supervise or regulate their accounts are the railroad companies, and the injustice of it all is that they are receiving the most.

It is very difficult to state what are the reasons for the adoption of this provision and the object which it seeks to attain. We are not familiar with the forces or influences which brought about its passage. It has been stated by some of the members of the Interstate Commerce Commission that the object of this law is to enable the Commission the better to detect and punish flagrant cases of rebating. This position on the part of the Commission seems most remarkable. While it is true that the Commission has a tremendous scope of power under this law authorizing it to prescribe the very books and accounts to be kept by carriers, sufficient to embarrass railroad economy and to demoralize discipline, yet this seems a very impracticable procedure, and to suppose that this one body as railroad bookkeeper can scrutinize or keep account of every transaction or negotiation attending the vast number of freight shipments made daily by 800 railroad companies operating 224,000 miles of lines in a country carrying the tremendous commerce that we do is absurd.[13] To attain this end would mean an army of government inspectors numbering hundreds of thousands, if not over a million, covering the entire land in every little freight agent's office at an enormous expense to the government and the people, while the opportunities and temptations for corruption and graft would be simply appalling and would prostitute the entire railroad industry to the pettiest kind of politics. If the Commission should really use the law for this purpose it would bring about its repeal at the hands of an indignant public more quickly than anything else possibly could.[14]

The situation in respect of railroad management in this country stands like this: authority of management has been greatly curtailed and wrested from boards of directors by state and federal laws. The authority of the Interstate Commerce Commission has been greatly increased, but its own responsibility or sense of duty not at all increased. The Government or Commission is responsible to no one, it has nothing to lose, while the investor and stockholder, who fur-

[13] This idea was actually put forward to the writer as one of the objects of the law, in personal correspondence with one of the Interstate Commerce Commission and, strangely enough, in seriousness, too. The position seems impractical and ludicrous. But see address of Prof. Henry C. Adams, the Commission's statistician, at Washington, October 11, 1907, before the Association of Government Accountants. His remarks indicate that the Commission under this law has no definite aim save to augment its own political influence in the management of American railroads. See able review of Dr. Joseph Nimmo, statistician and economist, on the judicial regulation of railroad affairs as opposed to administrative control.

[14] The advanced position taken now and then by the Commission in its efforts to stop rebating does not impress one with its earnestness. In fact, the Commission is disingenuous in this matter. Revelations of the last two years in rebate cases show that many of them occurred prior to the passage of the Hepburn Act and have been brought to light simply through the exercise of powers given the Commission under the Elkins Act. That law (Elkins Act), had it been faithfully enforced by the Interstate Commerce Commission and the Department of Justice, would have been fully as effective in preventing rebating as the Hepburn Act. This is the testimony of a majority of well-informed men on the subject.

nish the capital, have everything to lose, yet their voice in the financial management through their directors is reduced to a minimum. As to railroad directors and managers, they are responsible to all sorts of regulations imposed on them, responsible to federal and state commissions, to shipper and to investor. Yet in financial matters they have little authority, no latitude of discretion, no freedom of action. Held responsible by the public, they are powerless agents in the hands of many commissions which have all financial authority divided among them without one cent of capital at stake.[15] This sort of thing, of course, if followed to its logical conclusion, would crush individuality and demoralize the people, while the government would become more and more arbitrary and despotic.

In the very unfortunate results which have ensued after one brief year of railroad operation under the Hepburn Law and which we have briefly rehearsed, all people suffer, the shipper as well as the investor. But the investor and stockholder, whose rights are seldom regarded by politicians and never by commissions, have a complaint also against the president and directors of our railroad companies. It is that, while objecting in speech and written statement they have yielded with a singular facile compliance to the unlawful demands of the Commission in respect of railroad accounting. To protest by speech and public interview when partisan feeling is running high is of little avail. We think that, regardless of fears and personal inconvenience, in a broader and higher appreciation of their position, as trustees of the transportation interests of the country in which are invested thirteen thousand millions of dollars of private capital and personal savings, the most tremendous industry, perhaps, in the entire world, they should appeal to the protection of the Federal courts to check the autocratic assumption of unconstitutional power on the part of the Interstate Commerce Commission.

THE LOG OF THE NEW HAVEN ELECTRIFICATION.*

BY W. S. MURRAY,
Electrical Engineer N. Y., N. H. & H. R. R.

The object of this paper is to bring the actual operation of the New Haven single-phase electrification as closely as possible to those who are truly interested in its merits and faults. If the writer can feel that this object has been accomplished, the reward for the effort will be sufficient.

In advance of freely opening up the subject without mental reservation, it may be well to say that he is not unmindful of the adverse construction and criticism that will be placed by some upon the facts he intends to present. Having carefully weighed this, however, he has concluded that it should not be permitted to stand in the way of, or militate against, the sounder and analytical judgment of those intent upon a fair consideration of the facts as they exist.

The first intention was to make the subject of this paper "The Errors Made in the Electrification of the New Haven System," but realizing what capital such an "admission" would make for those few who are inclined not to be fair-minded on this important matter, the title has been changed, and the body of the paper built upon a description of the faults, major and minor, that have been made, and their effect, by log sheet reference, upon operation. After all, the citation of "how not to do it" is far more valuable than "how to do it." It may be at some sacrifice of pride to discuss one's errors, yet there is something so valuable in the exposition of an error that this, in itself, is ample compensation for its acknowledgment. There seems to be, too, something altruistic about a mistake or "wrong"; for in its death there is born a "right," and one can never really get on intimate terms with his mistake until his rightful complement has been substituted. After a railway has changed from a steam to an electric schedule, the natural question immediately follows: "Is it a success?" The answer to this question involves almost an infinity of analytical judgment. Electrical engineers have no greater professional or moral responsibility before them than the presentation of all available data, in which will be included information of pertinent application in the solution of the vast electrification problems of to-day. To those entrusted with the responsibility of such decisions is due every possible help and light. Engineering conclusions are based on 5 per cent. theory and 95 per cent. practice; practice being made up of experience and an acceptance of existing allied conditions. We want nothing unless we know all about it before it is ours. If we are wise, we should not be so particular about its merits as its demerits. Perfection cannot exist. This applies to electrification as to other things.

The duty assigned to the engineers of the New Haven Railroad was to provide for the electrical operation of their trains. At the early period of April 1, 1905, when we settled down to this responsible task, the data in the field, upon which to base real conclusions, were about 5 per cent., in comparison with the experience now available. If "Ignorance maketh the brave" I can only say that I am more than thankful we were so ignorant at the outset. I do not believe that this remark will need any explanation here. Could we have read the history of our errors, rather than have made them, I question whether we would have had the temerity—though I confess our convictions would have been the same—to ask the president of the New York, New Haven & Hartford Railroad Company to put up with the criticism, abuse, and unfair remarks that have been made by those ignorant of the facts, and of others who, perversely, were intent upon their own selfish, narrow course with manifested abandonment of all purposes to acquaint themselves with the nature, the scope, and the possibilities which lay easily within their knowledge, merely by the asking. To-day I am thankful to say, this negative attitude is giving way to the alarm made manifest by undisputed facts, which demand their own recognition. I have no personal desire to make any other engineer think as I do. If he sees the facts as I see them, then we will vote alike. To those who may be interested in my conclusion in regard to the New Haven Railroad electrification, I can simply say that if I were in favor of its use three years ago, that now, standing on the more stable ground of experience, particularly in regard to the department of faults, I am doubly in favor of it to-day. I shall, of course, be interested in those who share this opinion after reading this paper, but I shall be doubly interested in them if their conclusion has not, in the slightest degree, been influenced by my own, but has been formed entirely upon the contemplation of the faults severally cited. And let me quickly add I shall be equally interested in those who honestly disagree with this opinion.

Unlike steam traction, where the number of links in the delay chain is but one, electric traction has its delay chain composed of three links; namely, the power house, line and locomotive. A failure in anyone of these links may produce train delay or delays. Measured by the degree of their seriousness, these links, in the order of their effect on delays, may be mentioned in the order given. This is, of course, immediately apparent in that the power house affects all operation; the line, a considerable portion of the trackage, involving, possibly, several trains; and the locomotive is usually confined to its individual troubles, only infrequently affecting following trains. This order naturally has application to all forms of electrification, direct current, single phase or polyphase.

In the conception of the form of power house, line and locomotive to be used in the New Haven system, ignorance and lack of experience led those pertinently interested in its success to believe that while the chain of power generation, and its transmission and utilization for traction, was of a new character, that its links, however, were made up of principles long recognized and reliable. They were right in this conclusion, except that it did not include certain phenomena which could not have been anticipated, due to the combination of these old principles in the form of this new chain. For example, there was nothing particularly disturbing about an 11,000-volt, 25-cycle, three-phase power house, from which was to be taken most of the power from one of the phases

[15] Next to the Interstate Commerce Commission the Public Service Commission has done the most to bring about the present half-demoralized condition of railroad affairs in New York State.

*From a paper read at a meeting of the American Institute of Electrical Engineers December 11, 1908.

generated; or of a 300-ft., 11,000-volt, single-phase transmission line, from the terminals of which the same voltage was to be distributed, east and west, along the right-of-way of a railway; or of a locomotive with a transformer installed upon it to take 11,000 volts and step it down to 600 volts to supply 300-volt single-phase railway motors. Power houses of this character have been designed the world over, except perhaps that single-phase current in the amount to be utilized had not been used elsewhere. Transmission lines of 60,000 volts had been in constant use. And, except that there was a moving contact in connection with the current that was to go to the step-down transformers on the locomotives, transformers of many times the capacity and voltage were in universal use. The single-phase motor, indeed, may be said to have been new so far as the size required for the New Haven service is concerned, but tests made upon smaller units demonstrated beyond peradventure its tractive qualities and showed its characteristic curves to be closely similar to those of its prototype, the direct-current motor. This reasoning, in close consideration of each class of apparatus, per se, has proved itself correct, and such irregularities as have existed in the initial electric service, which the New Haven road offered to the public, while deserving the condemnation which the public can unfailingly offer, have been due to the ramification of a series of faults that have developed entirely outside the zone of previous experience. The delays (and public criticisms of them) have followed even into this late day, when the electric service is far better than the steam service it has replaced. It has occurred to me that certain engineers, who are unbelievers in the single-phase system, may interpret this paper as an apology. To them I would say, as I do to the public, it is an apology for having delayed any of their appointments. To others, it is needless to add that the citation of these troubles is given in the hope that they will, as they easily can, avoid them in the future.

THE SERIOUS FAULTS.

Power House.—The electric power supply for the New Haven road is derived from four 11,000-volt steam turbine generators, three of which have an electric capacity of 3,750 kilovolt-amperes single phase; the fourth unit consisting of a 6,000 kilovolt-ampere, three-phase generator, which can also supply single-phase current to the system.

Although the generators as originally designed were made exceptionally strong, and particular attention paid to their insulation, due to the necessity of grounding one phase, it was found that the utilization of so much single-phase current from a three-phase star-wound generator produced a stray magnetic field completely out of the path of normal lamination. As a result it was impossible to develop for continued operation more than 66 per cent. of the normal rating of the generators. Overloads of any character produced abnormally rapid heating, making such operation dangerous, although the generators were guaranteed to carry 50 per cent. overload for two hours, and 100 per cent. overload for two minutes in order to meet the sudden drafts of currents required for a schedule such as exists on the New Haven road. Indeed, at the very start the actual drafts of current showed that the generators must meet imperatively the guarantees as to normal and overload capacities if the electrification were to be successful. These, then, were the power-house conditions that confronted the New Haven road on beginning the work of propelling alternating-current trains. The power house being the heart of an electric system, to add more would be to say less in describing a critical situation.

I trust it is not to be my pleasure to meet the prophet, who says, "This could have been anticipated." Suffice it to say that after three unsuccessful attempts at complete correction, each, however, affording some constructive results—months being absorbed in the dismantling and readjusting of the parts of these generators—the final attempt was successful and the generators are to-day operating in the power house, fulfilling the guarantees mentioned previously. But this last mentioned fact is insignficant when compared with the valuable information that has been derived, which will permit all other generators to be manufactured without the fault described.

Line Insulation.—The years of experience which we have had in the study of insulating various voltages led to what was considered a very conservative insulation in the various parts of the line. Messenger cables had to be insulated from the intermediate trusses and at their anchor-bridge termini. The trolley copper conductor was suspended from the messengers and had to be insulated at points where it entered the oil switches on the anchor bridges. Trolley wires had to be insulated from each other at section breaks. On curves, both messengers and trolley wires had to be strained over the center of the tracks through the agency of pull-off posts at the side of the tracks, the pull-off wire being insulated between tracks and the pull-off column itself. Feeder wires had to be insulated from their supporting cross-arms and at points where they pass under highway bridges. None of these problems in insulation had the appearance of an especial character and, indeed, did the roadbed provide traffic only for electric trains, the problem would have been simplicity itself. A pressure of 11,000 volts being the prevailing dielectric strain, the problem was to provide sufficient insulation at all the points mentioned above.

Of the effect of steam locomotive discharges upon insulators, there was no initiative by which to be guided, and it became necessary to decide upon the factors of insulation that would be required. It was thought that ample provision had been made, it proved otherwise. Experience has proved that, in places, just double the amount is required. It was quickly noted that the greatest number of insulator failures occurred wherever the insulation was subject to the direct blast of the steam locomotive. To correct the difficulty, therefore, it was found necessary to double up on anchor insulators. The intermediate messenger insulators proved adequate and it was not found necessary to increase the impregnated stick insulation between trolley wires at curves, but wood stick insulators had to be added in series with the moulded material insulator between the pull-off wire and pull-off post. The original insulators on the anchor-bridge switches were made of moulded material and for them was substituted porcelain. It was not necessary to change the feeder insulators on the catenary bridge struts. While very little trouble has been experienced with the form of insulation used for supporting the feeders under highway bridges, it is anticipated that trouble will follow if this is not changed. The present form consists of the corrugated spool-type insulator, for which there will be substituted a regular porcelain double-petticoat insulator.

To-day, instead of line failures being the rule, they have become the exception.

Circuit-breakers.—The momentary energy involved in a short-circuit produced upon a line fed by high power, high-speed turbines is very great. Under the sub-title "*Power house*" it was stated that the generators were operating under their guaranteed capacities. Internal heating, due to stray magnetic field, was the cause of the generators failing to meet their designed capacity. This heating was completely cured by the simple addition of a short-circuited winding surrounding the rotating member of the generator, similar to that used in the well-known squirrel-cage type of induction-motor rotors. It is interesting to note here, however, that while the heating is entirely eliminated by this short-circuited winding, its effect on the occasion of a short-circuit is to allow more current to flow. This tendency, however, is controlled by a method later to be described. In the New Haven system, as the current from the power house was fed directly to the line and from there to the locomotives without transformation of voltage by transformers, the inductive element to counteract the surging current was practically negligible; under these conditions there resulted short-circuits which no circuit-breaker apparatus then designed could be relied upon to take care of.

Here it is expedient to point out the very marked difference in operating conditions between circuit-breakers used on a system that is grounded and one that is not. In either case, it is, of course, good practice to ground the frames of all circuit-breaker apparatus. In the case of the grounded system, this virtually brings one terminal of the generating system directly to the frame of the circuit-breaker; with the other terminal of the system connected to the jaws (contactors) of the breaker, it is readily seen that on the occasion of a heavy current surge, due to short-circuit, should the arc extend itself through the walls of the oil tank (wherein the circuit is broken), this would be a direct leakage to ground establishing a short-circuit around (or in shunt) to the circuit-breaker jaws, which action, of course, renders the circuit-breaker useless, and subjects it to the damaging effect

of the arcing locally produced until interrupted by another circuit-breaker in series with the circuit. On the other hand, where the system is not grounded, even should the walls of a circuit-breaker be broken down, as explained above, there would be no electrical connection (unless the neutral be grounded) between the circuit-breaker frame and the generator, and thus no return path for the current. I desire to draw particular attention to this point, for while the circuit-breakers used in our case open short-circuits, since the current surges have been practically eliminated, I believe that the lining of the oil tanks should have an especially high insulation factor on grounded systems.

The failure of circuit-breakers, either in the power house or on the line, naturally produced train delays of large or small magnitude. It was difficult to believe that these large circuit-breakers were incapable of taking care of the short-circuits, and some time was wasted in thinking this way. Therefore, we reluctantly but surely arrived at the conclusion that the conditions would have to be changed.

The remedy was simple. Instead of feeding the main line with a direct transmission straight from the power house busbars to the trolleys directly opposite the power house, the current was fed into the line over feeders connected to it at Port Chester and Stamford. By the introduction of this ohmic resistance, amounting to not more than 2 per cent. normal drop on the system, we were immediately released from the disastrous effect of short-circuits on our circuit-breaker apparatus. Instead of losing as many as half-a-dozen circuit-breakers in a day, not that many were reported out of commission for a month and, of course, they were not damaged to the extent as the others nor did they cause any serious delays.

For the feeder resistance, above described, there has since been substituted impedance coils installed in the leads of the generators. These coils act as shock absorbers, protecting the generators. Later, it is to be expected that there will be installed a circuit-breaker across the terminals of these impedance coils, which, for normal operation, will shunt the current through them, the breakers opening under stress of abnormal flow of current and automatically closing when normal conditions are restored.

Trolley Wire.—In the month of May, 1908, it became evident to us that within at least one month from that date, if some change were not effected in the contact wire, that the New Haven electric service would cease. While this truth was so plain, it may be best described by the fact that daily reports were showing that the copper trolley wire was breaking at various points; and where it was not broken it had become so badly kinked at the hanger points that it was impossible to operate electric locomotives upon the line without serious arcing. This resulted in violent surging on the locomotive transformers, and, at times, on account of the extremely poor contact of overhead shoes on the line, in reducing the voltage to such a low value as to prevent a sufficient supply of power to enable the locomotive to perform its schedule. An examination of the hard-drawn copper trolley wire throughout its length proved that even after only a few months operation upon it, its cross-section had been so materially reduced as to point to its short life with a continuance of operation upon it. Especially was this true in the vicinity of the many low highway bridges where the trolley wire approaches the bridge on a 2 per cent. gradient. This fault and dilemma were indeed serious. The cause of the difficulty was perfectly apparent; namely, the hard spots in the line which existed at the hanger points.

Many suggestions were offered. None of them, however, offered the speedy installation that was paramount. Mr. McHenry, Vice-President of the New York, New Haven & Hartford Railroad Company, made the suggestion that an auxiliary wire be suspended from the present copper wire by clips at its midpoint between the hangers, and followed up the suggestion that this auxiliary wire be made of steel, of the same cross-section as the 0000 grooved hard-drawn copper above it. It took two weeks for the manufacturer to draw two miles of this wire. It was installed immediately upon its receipt on the main line between Port Chester and Harrison. On the night of its completed erection a special seven-car train with two locomotives was operated upon it for several hours. Previously to the installation of the steel wire there had been installed a section of hard alloyed wire suspended in a manner similar to that of the steel. The electric train was operated upon them both, officials from both the railway company and the contracting company being on hand to note their comparative merits. It was the general consensus of opinion that there was less sparking on the hard wire, and the general tendency was towards adopting that rather than the steel. Though admitting that the operation was better, the steel seemed to be of an entirely satisfactory commercial nature, and all present finally concurred in this conclusion. It is undeniably true that hard alloyed wire would, from a purely operative point of view, be the better of the two, and yet the commercial aspect, which would naturally include its cost, had to be considered, particularly in reference to so large an immediate order as one involving 100 miles of single-phase electric trackage. Again it is important to note that the steel, besides having the advantage of being a cheaper, harder and stiffer wire, also possesses a lower coefficient of expansion and higher elastic limit, especially valuable characteristics for the service desired. We found that we would be considerably delayed in the delivery of the steel, but an immediate order of 20 miles followed by another for 40 was placed, and as much hard alloyed wire put up as could be obtained between the date of the conclusion to use the auxiliary wire and the final arrival of the first shipment of steel. The auxiliary wire construction on the main line, as described, prevails throughout the whole system, except at the approaches of and under a few very low highway bridges, where the contact system consists of two wires strung in the same horizontal plane.

The New Haven trains have been operating now on the auxiliary wire for several months, and absolutely no kinking has been noted at the hanger points, with the attendant result of a smooth and almost sparkless overhead contact.

Locomotives.—There were originally purchased 35 locomotives, which was considered an adequate number to take care of the New Haven passenger service. These locomotives, considered *per se*, were rated on a half-unit basis. That is to say, the half unit was designed to handle about 75 per cent. of our trains, the remaining 25 per cent. to be handled by two units. Only a short experience in commercial operation revealed two important facts. The first one of a very encouraging nature, the second, decidedly otherwise. The first was the proof that the two main parts of the locomotive; namely, the transformer and motors, had sufficient capacity to more than handle the manufacturer's guarantees. The second was the discovery that many of the auxiliary electrical and mechanical parts of the locomotive equipment were not of equivalent capacity. The strength of the chain being measured always by its weakest link, it was immediately seen that the locomotives would be able to handle trailing loads in excess of their guarantees if the auxiliary parts were made of sufficient capacity to furnish the necessary current for the overload conditions. It was simultaneously apparent that more locomotives would be required to provide for an increase of train service and the reduction of time schedule, and an order was promptly placed for six additional ones; before accepting their design, however, a careful survey was made of all the component parts of the locomotives at hand, in order to determine the changes necessary to be incorporated in the six new engines. To accomplish this it was found necessary to make a number of electrical and mechanical changes, the nature of which is apparent in the following tabulation:

MECHANICAL.	ELECTRICAL.
Air Reservoir System. Revised.	*Ammeters.* Revised.
	Battery. Charging relay installed
	Blowers. Commutator slotted.
Boilers. Installed.	Waste rear bearing.
	Armature laminations ground.
	Bearing raised above center.
	Motor winding revised.
Stack hood removed.	*Controller.* Bushing riveted.
	Shoe and trolley switch installed.
Bell Rope Installed.	*Circuit-breaker.* Fused.
	Tank bolt secured.
	New type installed.
	Compressor. Commutator slotted.
Blowers. New design installed.	Armature laminations ground.
	New governor installed.
	Bearing raised above center.
	Cut-out Boxes. New drums.
Guide on present damper rod.	*Fuse.* In alternating current heater circuit.
	New auxiliary fuse box (wooden.)
Extra guard on shutter.	Auxiliary motors separately fused.

MECHANICAL.

Bolster. Reinforced on truck.

Brakes. New release spring.

Cylinder leads lengthened.

Check nut on adjuster.

Compressor. Drip pans installed.

Exhaust pipe installed.

Air-cooled cylinder head.

Check-valve. In whistle pipe

Gage. On oil tank.

On steam line.

Journal-box. Revised gibbs.

Quill-plate. Washers installed.

Running-board. On roof.

Semielliptic springs. 14 leaf.

Safety valve. On control resistance.

Safety-chain. Made heavier.

Torque rods. Heavy installed.

Uncoupling lever. Revised.

Pony wheels. Installed.

Valve. On oil line to boiler.

ELECTRICAL.

Grounding switch. Installed.
Control revised.
Shutter in cover.
Heater switch. Shield installed.
Heater bus-bar line. Reinsulated.
Couplers repaired.
Headlight. Adjusted properly.
Porcelain switch installed.
Motors Holders reinsulated.
New cross—connecting leads.
Housing asbestos lined.
Linen tape on commutator end.
Side commutator covers perforated.
Perforated S. I. commutator covers.
Field clamp bolt secured.
Motor-generator. New switch.
Preventive coils. Revised.
Supporting frame revised.
Direct-current relay. Connection to "—S" switch.
Washer installed.
Resistance. Insulated.
Capacity increased
Connected ahead of motor.
Switch group. Revised shunts.
Revised studs.
Revised arc shields.
Copper reverse switches.
One-turn blowout coils.
Air ports enlarged.
Alternating current frames insulated.
Cylinder alining set screws.
Reinforcing wooden strip.
Interlocked reverse switches.
Fitting alternating current switches.
Group covers perforated.
New B. O. coil pole piece alternating current.
Switch. Block on direct current case.
Main switch, connection modified.
Canopy switch handles insulated.
Shunt remounted. Direct current ammeter.
Trolleys. Control revised (alternating current).
Side bearing springs (alternating current).
Insulate back cross-rod (alternating current).
Shield for high tension lead (alternating current).
Spring shortened (direct current).
Insulator filled and painted.
Temperature Indicators.
Third-rail shoes. M. I. bracket.
Pin replaced by bolt.
Jumper installed.
Shoe levers cut off.
Fuse boxes—Refitted.
Wattmeter. (Auxiliary) installed.

The most important electrical changes made were in the switch-groups and brush-holders of the motors. The former lacked carrying capacity and the latter sufficient insulation. To these shortcomings were due the greatest number of our first train delays. The most important mechanical changes necessary were the reinforcement of the truck bolsters and installation of pony wheels. The especial reference to these electrical and mechanical changes must not be construed as diminishing in any way the force of necessity of the others, as they were all considered absolutely necessary in order to preserve a low cost of electrical and mechanical maintenance.

With the exception of the installation of pony trucks, the six new electric locomotives arrived within five months of the date of their order. In their design were included all of the changes above specified. To be noted here is the marked value of the spring type of armature and field suspension begun with the New Haven locomotive motors, thus making flexible the entire motor suspension. Indications already predict that this arrangement in combination with the pony trucks will reduce materially the track and locomotive maintenance and repairs. To-day the reconstruction, as above described, has been effected on over 90 per cent. of our locomotives.

This last and serious fault with which we had to contend completes the major difficulties that were constantly threatening the regularity of electric service.

It seems to be the time and place, here, to draw attention to a point in design concerning the New Haven locomotives that has been so persistently misrepresented by those who seem to have been ignorant of the facts. The specifications upon which the locomotive units were purchased, as stated hereafter, were that each unit would handle a normal trailing load of 200 tons. The writer, by careful measurement of the weights of all the trains (trailing loads) in the New Haven service, found that they averaged 212 tons. It seemed good engineering that if 75 per cent. of the service could be handled by locomotives rated upon a basis of 200 tons trailing load, that that would be the correct locomotive unit size; using two units for the remaining 25 per cent. of the trains. To-day, three years after this decision, we find that 73 per cent. of our trains can be handled with single units, 27 per cent. requiring two units. The percentage is slightly different from the original, as the service is slightly heavier.

Coincident with the use of the first double-unit locomotive trains there was started a rumor that the New Haven locomotives did not have the capacity for which they were designed. To dispel this idea forever, I judge the best argument is to refer to a table, wherein are stated the trains whose weights were in excess of trailing loads the locomotives were designed to carry. [This table shows that in the week from Oct. 18 to 24, on the miscellaneous trains running in local and express service between the Grand Central Station and New Rochelle and Stamford, including a total of 78 trains, in which all but 6 of the 41 locomotives participated, the trailing weight of the trains ranged from 222 to 400 tons when hauled by a single unit and from 538 to 853 tons when hauled by two units, with a percentage of overweight for the whole of from 3.2 to 70.4, and not an instance of normal loading.—EDITOR.]

I trust that the above clears up any erroneous ideas concerning the capacity of the New Haven locomotives, and will justfiy the future double-unit trains entering and leaving the Grand Central Station.

Recapitulating, I believe my brother engineers will agree that with the coincident difficulties described in our power house, line, circuit-breakers, trolley wire, and locomotives, the work of instituting electric service was not exactly laid over a bed of roses. These are the serious faults the system possessed and the description of our method of elimination of them that I am glad to be able now to place before you. We cannot blame the public for making the complaints they have against the New York, New Haven & Hartford Railroad Company's electric service, for to the traveling public there is nothing so exasperating as a train delay. It is fitting here also to say how appreciative the engineers of the New Haven road feel for the calm and generous suspension of judgment on the part of those engineers who have reserved opinion until it could be based on facts which time only could so demonstrate as to permit presentation. There are many other little faults and difficulties here and there throughout the system, but the five described, though not fundamental in their effect, since they have been removed, were none the less the most serious.

THE MINOR FAULTS.

Generator Burn-outs.—Previously to the rearrangement of the feeders or the installation of the choke-coils in the power station, the short-circuits that were experienced on the line naturally had a deleterious effect on the generators. The prodigious rush of current naturally produced severe strains in the armature windings, strains whose mechanical intensity was made manifest by the movements of the coils. Therefore, during this period of violent short-circuits, frequently the generator coils were grounded and burned out. Since the rearrangement of feeders or the installation of choke-coils, the violent short-circuits have disappeared and with them the damaging effects on the generators. It has been found advisable, from time to time, to connect different generator terminals to the line. By this arrangement the three phases of the generators are in turn worked equally.

Distribution.—Although the arrangement of the line in its present feed and trolley connections effects the highest economy in loss of power by transmission, it is questionable to my mind whether this economy is worth some of the disadvantages which accrue from this arrangement. Until we had experienced the heavy current surges, due to short-circuits, it seemed reasonable that, should a short-circuit occur on the line, the two circuit-breakers which immediately fed that short-circuit would be the ones to respond. We were quite correct in this conclusion, but did not go far enough, as other circuit-breakers seemed to feel it their duty to relieve the situation and their location with respect to the correctly involved breakers was quite varied. Of course the ideal con-

dition would be to have only the two breakers adjacent to the short-circuit open, as by this arrangement the voltage would remain on all trolleys except the one in which the ground is involved. This operation can be effected, and at the time of this writing an effort is being made to obtain these results in practice.

A less efficient method of line transmission than that described in the previous paragraph (using the same amount of copper for each case) is one in which each track has its own individual voltage supplied to it and is kept separate from the other trolleys.

Contact Wire.—While the auxiliary wire, as previously described, was the panacea of our difficulties, and has given an excellent account of itself since having first been placed in operation, it is fair to believe that even a more sparkless operation can be obtained from an auxiliary wire which, instead of being attached by a rigid clip to the overhead copper conductor, is simply suspended from it by a loop, thus permitting the contact wire to rise slightly as the upper pressure of the pantagraph shoe travels along its surface. The contact wire should be anchored by turn-buckles to permit slacking and straining of the wire in winter and summer seasons, respectively.

Hard Spots in Line.—Irregularities in the contact wire may be due to two causes. First, those that exist in the wire as it is manufactured; secondly, those formed on account of hard spots. The former can be taken out; if not, they are usually ironed out in the course of the operation of the shoe on the trolley. The three principal sources of hard spots are derived from hangers, section breaks and deflectors.

1. It has been shown in the foregoing how the hanger hard spots have been eliminated.

2. The original main-line section-break consisted of a rectangular impregnated wood frame suspended under the anchor bridges. The trolley wires were carried on opposite sides of this rectangle lapping, of course, a sufficient distance in the center so as to permit a short period of simultaneous contact of the shoe with both trolleys, thus preserving continuity of current to the locomotive in passing from one section to another. It was found that these rectangular section breaks were prone to get out of shape, introducing a very rough spot in the line, its effect being, on the passage of the shoe, to draw long arcs which frequently extended themselves to ground. Our new section break containing all the flexibility obtained by the auxiliary wire, has been constructed by simply staggering the messenger insulators of each trolley 16 in., thus permitting the anchor bridge trolley wires of the same track to pass at this distance. Each trolley wire is dead-ended to a wood impregnated stick insulator, supported by the messenger of its opposite section. By this arrangement practically all inertia is taken out of the section break and a sparkless passage between sections is obtained.

3. The auxiliary wire construction has been, of course, applied to the deflectors, and this has greatly reduced the tendency to spark at these points. In order to prevent the pantagraph shoe from engaging the wrong trolley wire at turn-outs on diverging tracks, the mesh construction of the overhead frog has up to this time been the only solution, but this method seems unduly cumbersome and even a greater improvement is anticipated than that secured by the application of the auxiliary wire.

Signal Wires.—The catenary bridge struts carrying the cross-arms for the by-pass or feeder wires, likewise carry the cross-arms upon which are installed the signal wires. The voltage placed on these signal wires is entirely distinct from the propulsion voltage, it being 2,200 volts and 60 cycles. The proximity of the wires of these two systems has been the cause of short-circuits between them, resulting in double failures. It would seem that as the signal system should be so completely separated from the propulsion system, it should be installed on an entirely separate pole line. If, however, right-of-way conditions make it absolutely necessary that the supporting structures of the catenary system should support also the signal wires, then the two circuits should be made as distinctive as possible, the propulsion system having its wires on the cross-arms on the railway side of the struts, the signal wires being installed on the opposite.

Locomotive Current Collectors.—An efficient pantagraph shoe has proved itself a very difficult problem. The present cost is about .06 of a cent a locomotive-mile. We have made various experiments with aluminum, phono, copper and steel rigid and spring-supported pantagraph shoes. While this feature does not present a serious aspect, it is none the less a most interesting study. Shoe life is also seriously affected by the amount of soot deposited by the locomotives upon the overhead wire. While we have obtained mileages varying between 600 and 1,500 miles per shoe with various types used, other roads of lesser speed and not subject to the effect of locomotive stack discharges, have obtained as high as 25,000 shoe-miles.

THE LOG OF OPERATION.

Electric Passenger Service.—So great was the demand for electric service that in July, 1907, long before we were ready, as the records of our operation have proved, the first commercial service was begun between New Rochelle and the Grand Central Station. With all speed possible the electrification was pushed eastward and local service was established from Port Chester in August, 1907. Local service from Stamford followed in October, and finally, on July 1, 1908, all through and local passenger trains were under electric schedule between Stamford and the Grand Central Station. It is, therefore, beginning from this date of July 1, 1908, that I have compiled data of our operation as taken from our records. We are not proud of it, but we believe that you now know of some of the obstacles that stood in the way of its immediate betterment at that time.

Comparison Between Steam and Electric Service.—It had been the hope of the writer to be able, even at this early date, to make an absolute comparison between electric service and the steam service which it has replaced between Stamford and New York, including all passenger trains. On account of the speed restrictions that have been introduced on the electric service until all locomotives have been reconstructed with the new pony truck equipment, it is impossible to compare train-minute delays, for the reason that steam locomotives are permitted to make up time while to electric locomotives this privilege is denied. Later, when this restriction is removed, and especially after a period of time more extensive than that offered by the present comparatively short period of operation, these data can be presented. Particularly worthy of notation here in comparing steam and electric service, it is necessary to bear in mind that while the operation of the power house does not differ from that of ordinary practice, there is a marked individuality (which initiative always brings), in connection with the operation of the line and locomotives. While every credit is due the present organization charged with the responsibility of line and locomotive operation, it cannot be forgotten that these two main links of the system are essentially new in their adaptation to the heavy conditions presented by the New York, New Haven & Hartford train service. Operation of this character is so far beyond the scope of previous experience that it was absolutely impossible to foresee and prevent all contingencies. The methods for the prevention of failure and delay were necessarily based upon the results of actual, practical operation.

Individual and collective train-minute delays in electric zone, due to failures in power house, line, and locomotive.—[The tabular statement accompanying the paper gives, in detail, the amount and causes of the daily delays to trains for the months of July, August, September and October, 1908. The failures are attributed to the power house, the line and the locomotive. In August there were two power house failures resulting in a total of 132 minutes delay, both of the turbines, and these were the only ones chargeable to that source in the four months.

On the line there were nine delays aggregating 182 minutes in July; all but one being chargeable to the circuit breakers, and that one was lack of current in the direct-current rail. In August there were 14 delays aggregating 452 minutes, of which six, totaling 322 minutes, were due to circuit breakers; five with 84 minutes from the insulators; one for five minutes from a ground on the signal wires, and two of 17 minutes from third rail troubles. In September there were nine line delays with a total of 71 minutes, with but three and 27 minutes chargeable to circuit breakers; there were four delays with a total of 24 minutes due to line ground; one of 16 minutes due to grounded insulator, and one of four minutes

due to the signal wires. In October there were ten line delays of 277 minutes, of which but four, giving 89 minutes, were due to the circuit breakers; one was a direct-current circuit breaker of 31 minutes and is scheduled as a mean failure; three were insulator failures of 128 minutes.

On the locomotive there were 27 failures in July, to which 583 minutes are charged. They are miscellaneous in character with perhaps a more frequent recurrence of pantagraph failures than any other. In August there were 38 failures, causing 407 minutes delay, of which three, with 150 minutes, were due to water over the rails in the direct-current zone, and one with 11 minutes to the engine despatcher, so that the locomotive failures drop to 34 and 246 minutes, in which the third rail shoes and the pantagraph play the most prominent part. In September the engine failures were 30 in number, charged with 224 minutes. In this there were three charged with 12 minutes because of low direct-current voltage; one derailment of a pony truck that lost 28 minutes, a hot box three minutes and a hot tire 10 minutes, so that the electric features, in which the pantagraph is still prominent, are responsible for but 24 failures and 171 minutes. In October there were 31 failures charged with 243 minutes, but of these seven and 86 minutes were for hot boxes, brakes sticking, air hose and similar failures, and were in no way chargeable to the electric engine in itself. The direct-current shoes, the pantagraph and the switches still furnished the major portion of the failures.—EDITOR.]

The segregation of these failures based upon train-minute delays offers a quick and interesting comparison. It is to be noted that the last two months indicate a great improvement over the two preceding ones. From the chart have been taken the train-minute delays that have amounted to over 300 minutes per diem, which are treated separately in the following paragraph. My reason for doing this is to make the data inclusive of ordinary operating days, in order to get the monthly comparison of train-minute delays for what might be termed ordinary service. It is interesting in reviewing the "cause of delay" in this table to note that 90 per cent. of the causes are of an inconsequent nature, and might be reasonably expected when considered in the light of an initiative service.

Serious failures in system causing over 300-minute delays.—It is to be noted that these failures are indicated by the dates of July 14, 16, 20, 26 and 27; August 6 and 8; September 8 and 26, and October 19. A description of the cause of one applies to all of them, except those of July 16 and October 19. In every instance, excepting the two dates mentioned, the tie-up was due to simultaneous failure of several circuit-breakers, due to a short-circuit, thus temporarily disorganizing the distributing system, preventing the electrification of trolley wires.

On July 16, the White Mountain Express left the rails just east of Greenwich station, tying up both eastbound tracks, and causing excessive train-minute delays. Except for the electric rail bonds which suffered destruction, no other electrical apparatus was disturbed. One of the electric locomotives attached to this train was immediately returned to service, the other following it the next day after light repairs were made to its pilot and third-rail shoe mechanism.

On October 19, although the impedance coils in the generator station were in action, a ground occurring on the bus-bars of the anchor bridge directly outside of the power station, in combination with a defective circuit-breaker, produced a short-circuit which destroyed the operating mechanism of the breaker in question. This unfortunately occurred at a time when temporary connections had been made between the power house and line; on this account a serious delay was experienced in restoring the voltage to the line.

It is interesting to note that since the complete inauguration of electric service, the serious failures in the system have been reduced from five to one.

Engine Repairs.—Under "faults" is described the necessity in detail of our engine reconstruction. Since 100 per cent. service has been established, it has occurred to me that the shop reports concerning the daily number of engines which are out of service on account of repairs or for other reasons, would be interesting. On account of the reconstruction being done on the locomotives, it has been found necessary to give up on an average three electric locomotives at Stamford and three at New Haven, the new bogie trucks being installed on the engines at New Haven. Thus out of 41 locomotives we have had only 35 to handle the complete passenger service. This has resulted in requiring that the New Haven locomotives handle the service with virtually no spare engines. [Tables are given under the headings of inspection and repairs, indicating how few have been the engines in the shop for the past three months, and is an attest of this requirement.

These tables show that during July 38 engines were withdrawn from service for reconstruction, or an average of 1.41 per day. Two were out of service for a day each for experiment and test. Ten had trucks installed and were out of service for one day each. Nineteen were pulled off for inspection, or at the rate of 0.71 per day, and 34, or 1.26 per day, were taken off for miscellaneous repairs. Of these four were for loose tires; three for broken axles, and seven for truck troubles. There was one hot box, a case of too much side motion, and the rest were electrical troubles.

In August 36 engines were reconstructed with an average of 1.39 per day. Three days were used for experiment and test. Trucks were installed on six engines. Ten were hauled off for a day each for inspection and 45 engine days were consumed in repairs, or at the rate of 1.73 per day. Five of these days were spent on the trucks, and three in waiting for wheels.

In September 58 engine days were spent in reconstruction; two in experiment and test; 41 in installing trucks; five in inspection and 10 in repairs. With the exception of one day spent on wheels, the balance were for electric troubles due to grounded switches and motors.

In October 84 engine days were spent in reconstruction; seven in experiment and test; 60 in installing trucks, none in inspection and but three in repairs.

During this period the train service was heavy and constant, as shown by the following schedule:

	Total No. of Trains	Average Per Day.
July	3,475	112.1
August	3,502	135.
September	3,295	132.
October	3,380	125.

EDITOR.]

The Capacity of the Electric Locomotive.—The capacity of the electric locomotives was based upon their ability to handle a trailing load of 200 tons in local service with stops averaging those that exist between stations between New York and New Haven. As a matter of fact, the station stops between Stamford and New York average very much greater than between New Haven and New York, and as very quick turns are made at both termini, the service may be said to be more severe under these conditions than under the guaranteed conditions of purchase. It is interesting to note the trailing loads, taken at random, hauled by the New Haven electric locomotives for the week ending October 24, 1908. [The range of these has already been noted, and it may be added that the average, as given in the table, is 309 tons per engine.—EDITOR.]

Comparative Steam and Electric Engine Mileage.—September 5, last, Labor Day, offered an interesting day to note what mileages could be made by the electric locomotives. Table IX. gives an individual record for each of the 38 electric locomotives in service that day. [A table giving an individual record of the 38 engines in service on that day shows that a total of 248 runs were made, or an average of 6.5 per locomotive, and that in making these runs, the total mileage amounted to 8,051, or an average of 212 for each locomotive.—EDITOR.]

In obtaining an average for all electric locomotives of 212 miles, it is to be remembered that this was made for all classes of service, express, express-local, and local, and further that the mileages were made over three short terminal runs; namely, Stamford, Port Chester and New Rochelle to New York, the distances being approximately 34, 26 and 17 miles, respectively. As indicated in the table, several engines made eight runs, two of them nine and one ten. It is difficult to get an exact comparison for steam locomotive-mileages. All of the electric engines are confined to one division, while the steam locomotives do inter-division service. However, using the records of the 1906 steam service for Labor Day and considering steam locomotives doing mileage in and out of the

present electric zone, out of 117 locomotives the following record is to be noted:

10	made	over 300 miles.
20	"	between 200 and 300 miles.
21	"	" 150 and 200 "
34	"	" 100 and 150 "
32	"	under 100 miles.
117		

Thus with division limits double that of the present electric division, and with the additional advantage of inter-division runs, the electric mileage for this concrete case averaged 34 per cent. better than the steam mileage.

THE ELECTRIFICATION IN ITS RELATION TO MATTERS OTHER THAN TRACTION.

Telegraph and Telephone.—Single-phase electrification affects telegraph and telephone systems whose wires lie parallel with and in close proximity to the railway. The corrective for this disturbance has proved to be simple and not costly. Briefly described, it consists of compensating transformers whose secondaries are a part of the telegraph and telephone wires and whose primaries receive their voltage from pilot wires strung on the same cross-arms as those bearing the telegraph and telephone wires, and thus having impressed upon them the same voltage, by electromagnetic induction, as the telegraph and telephone wires. The transformer secondary voltage is approximately equal and opposite to the induced voltage on the telegraph and telephone wires and thus constantly compensates for it throughout all ranges of induction due to the single-phase wires.

An interesting commentary on the efficacy of the compensating transformer is that its use obviated the necessity of any change in the physical location of the telegraph and telephone lines within the zone of induction, and has thus been the means of removing what at first was rightly considered a very offensive attribute of the single-phase system.

Public Safety.—As no fatality to the traveling public has happened by reason of the high-voltage wires since the system has been in operation, this would indicate the safety involved in its construction. The catenary form of construction as applied to the suspension of the trolley wire virtually eliminates all danger of these wires falling. On the other hand, the feeder or by-pass wires are not suspended by messengers, and although the 300-ft. spans used in this construction are not uncommon, it has been considered a wiser policy to reinforce all such spans which are above passenger platform stations. It may be of interest to state also that the scheme of reinforcement is not to cradle or place supplementary wires in connection with this span, but simply use a steel wire with a large factor of safety reinforced by copper for conductivity conductor and supported from the struts by insulators. The resistance to ground of this construction will be far in excess of the ordinary insulator used in the open construction with the steel wire connected to it in such a manner as to make impossible the burning of this wire in two in the case of the insulator breaking down.

Foreign Wires.—All electrifications are subject to foreign wire crossings. As in the case of suspension of high-voltage wires over passenger platforms, instead of using supplementary catenaries or cradles, the safer (and incidentally the cheaper) method of crossing is to use at the crossing heavier (and possibly guyed) poles, better insulation, and larger wires than are commercially necessary in the other parts of the foreign transmission line. High factors of safety with economy are obtained following this policy.

COMMENTARY.

Lightning Protection.—An ideal arrangement of catenary construction in relation to lightning protection would be to have the overhead messenger system grounded, and from it suspended by insulators a secondary catenary system, to which in turn would be attached the contact wires. Even in the New Haven case, where the overhead messenger system is not grounded, lightning has given but slight trouble. This is probably due to the very great number of grounded steel trusses and struts projecting above the electrified wires. Lightning was the indirect cause of one of our delays, but played only a small part in the real cause which can be attributed to the surge of current occurring at the time lightning caused a ground. At that time the feeders had not been rearranged, nor had the impedance coils been installed in the power-house circuits. On the occasion of this ground, due to the lightning, we lost several of the anchor bridge circuit-breakers; this naturally tied up the distributing system, preventing the proper restoration of voltage to the trolley wires. The conditions are now such that the circuit-breakers will relieve short-circuits due to this cause.

Grounds.—Structures supporting high-voltage insulators should be grounded. Particularly is this true of structures foreign to the railway company, such as highway bridges. This arrangement insures a prompt response of the circuit-breaker apparatus, and carries out the good practice universally applicable, that the material supporting the insulator be grounded. This principle has application in wood-car construction. Positive grounds between Pintsch gas pipes and both car trucks should be made to avoid any arcs being drawn under the car body. On two occasions the gas in the Pintsch mains of New Haven cars has been set on fire on account of connection with electrified wires. While the percentage is low, being two cars in about 400,000 during the period involved, with little damage in either case, and that to the cars, it is a matter not to be ignored.

Many of our catenary bridges, of both the intermediate and anchor type, serve to support signals. Signal men have been entirely free from coming in contact with the high-tension wires, by the simple provision of grounded close mesh screens interposed between the signal platforms and the high-voltage wires. The value of two grounds can be rated considerably higher than twice that of one.

Tell-tales.—Tell-tales in connection with an overhead system offer a peculiarly difficult problem. It is quite apparent that the pantagraph current collecting device would get into either electrical or mechanical difficulties with the present form of tell-tales. We have experimented at some length in trying to produce an electrical horn that would be automatically sounded by an approaching train. There is nothing particularly difficult in getting the automatic action or in producing a noise. The superiority of the tell-tale over the horn, however, is that no matter how much noise the freight train is making, the tell-tale always notifies, while in the case of the horn should the freight train be making more noise than it, the notification is lost. A horn if used for this service should be a large one.

As a matter of fact, the necessity of tell-tales is a bit of a relic of the barbaric past. In the days of hand brakes, the brakeman had to walk the roofs of cars, and low bridge warnings were necessary. To-day the braking is all done from the engine cab, except in yards where, of course, the overhead wires have their normal height of 22 ft. from the rails, permitting safe clearances for manual operation of the brakes.

Train lighting and heating.—On account of the necessity of wiring for electric heating and lighting some 2,500 coaches, it seems reasonable to retain the present method and apparatus of heating and lighting the trains in the electric zone. To accomplish this it was only necessary to supply each electric locomotive with a small steam boiler used solely for train heating. The Pintsch gas system has been retained intact. Later, when the service is sufficiently extensive, all trains will be heated and lighted by electricity.

All multiple-unit cars are to be heated and lighted by electricity. The problems of heating and lighting a multiple-unit train and a locomotive train are quite different. In the former the current is fed into the train at several points, as many as there are motor cars; in the latter it can be taken only from the locomotive (if there are two locomotive units, of course, it can be supplied from both). Again, in the case of the multiple-unit equipment, the supply of current is along progressive points of the train-length, thereby not requiring train bus-bars of excessive copper section, while in the case of the locomotive train, the supply, whether from one or two units, will be at the head end of the train, thus requiring a transmission of considerable length. A train of 12 cars, for instance, would be between 700 and 800 ft. long. Allowing 24 kw., maximum, for heat and light per car, would require the delivery of about 300 kw. apparent power. An investigation of this department in electrification has brought out some interesting details, particularly in reference to locomotive transformer design and electric car jumpers.

Fatalities.—As has been pointed out, we have had several fatal accidents, due to men coming in contact with electrified wires. We are none the less concerned that in every instance they were men employed by the company. In each instance the accident was due to carelessness or violation of instructions, and most of the accidents occurred during the period of construction. The operating period has provided a less number of these unfortunate events, and the records to-day now seem to indicate that the future will be free from this most regrettable feature.

Cross-catenary versus bridge-bents.—The excellent results of a year's experience with cross catenary construction in our Port Chester yard, where as many as ten tracks are spanned, is tempting encouragement for its application to main line work. Should the cross-catenary be used, anchor bridges should be spaced at close intervals, say one per mile. The question of the use of cross-catenary versus the bridge-bent on multitrack roads, however, depends largely upon the right-of-way conditions. Cross-catenary struts have to be guyed. In many instances right-of-way limits will require the guy to be placed on foreign land. If the additional cost of the foreign land brings the catenary bent up to or more than the cost of the bridge-bent it loses its object.

Single versus double-catenary construction.—Lack of operating data led the engineers of the New Haven road to take no chances with the overhead construction, and the double catenary was considered the safest. The adoption of single, double, and compound systems of catenary suspension is so intimately and definitely related to the number of tracks, the length of longitudinal spans, and the cost of transverse supporting structures and foundations, that the determining of the most economical type of catenary construction must necessarily include the consideration of these factors, and for this reason simple standardization adapted to all conditions is impossible.

Single-phase operation.—The New Haven system provides that the volt manufactured in and leaving the doors of the power house, is the same physical volt that knocks at the doors of the locomotives. Thus the line is the single link that unites the power house and the locomotives. All such adjuncts as step-down transformers, synchronous converters, storage-batteries, and low-voltage distributing systems with their necessary attendant complement of help is dispensed with. The Cos Cob power house has the usual number of men for a station of its output, and the locomotives are operated by the electric locomotive engineer with the customary assistant present for emergency. This crew holds good for single or double-unit trains. An emergency repair train is the guardian of the line, attending to all matters pertaining to its repair and maintenance. Including the night and day crews of the emergency train, the number of men employed to maintain the distribution system is nineteen. This covers about 100 miles of single track, including yards.

Conclusion. The writer will not use the conventional method of summing up and making recommendations. The paper has been written with the intent to lay before the members of the American Institute of Electrical Engineers a practical picture of the New Haven single-phase electrification, describing the first suit of clothes it wore and what it is wearing now. He is conscious of the innumerable little points of real interest that time and opportunity have not permitted him to insert here, but he trusts to the discussion to bring them out. The description of the faults and how they were handled will answer for the usual column of recommendations. In concluding, an interesting definition of engineering comes to mind; namely,

Engineering is the art of making a dollar earn the greatest interest.

The writer has intentionally omitted the discussion of the operating costs of a direct current versus an alternating current system; but, bearing in mind the preceding definition, it is his belief that in the electrification of steam roads to-day straight alternating current traction is the agency through which that title can be earned.

History sustains the undeniable truth that alternating current is the preferred agent for the transfer of electricity where either distance or capacity is involved. A railroad involves both. Granted, therefore, that the alternating-current traction apparatus has received the trade mark of practicability, what further argument does it need in its favor?

In connection with the New Haven electrification I wish to speak of the privilege of association with Mr. E. H. McHenry and Mr. Calvert Townley. Upon Mr. Townley devolved the responsibility of decision as to the form of electrification selected. Neither the object nor the scope of this paper can include a description of the analytical course of procedure preparatory to the conclusion that the New Haven road would adopt the single-phase form of electrification. Suffice it to say that Mr. Townley's conviction to accept this responsibility were sufficiently strong to lay the foundation of this work. To Mr. E. H. McHenry, whose serious illness had prevented his filling the office of vice-president in charge of matters pertaining to engineering, fell upon accession to that office, the responsibility of ratification or disagreement with the policy as set forth by Mr. Townley. That ratification is better written in the details of the electric zone itself, as in each department of power house line and locomotive may be seen the betterments due to his suggestion. To him is due the credit of the practical issue of this electrification.

This paper would indeed be incomplete did I not refer to the splendid courage and indomitable pluck of our contractors, who through a fire of criticism and business depression perseveringly stuck to their belief in the principles they were advocating. They can now have the satisfaction of viewing something begun and something finished; for while there may be many improvements to accrue to the alternating-current, single-phase system, the trunk-line principles have by them been laid and demonstrated.

STANDARD ATLANTIC AND MOGUL LOCOMOTIVES FOR THE HARRIMAN LINES.

The American Locomotive Company has recently completed the last of an order of 125 locomotives for the Harriman Lines. This order included 43 consolidation locomotives, 30 moguls, 10 Atlantics, 24 ten-wheelers and 18 switchers, all of which were built to designs and specifications which have been adopted as standard for all the roads, included in this system.

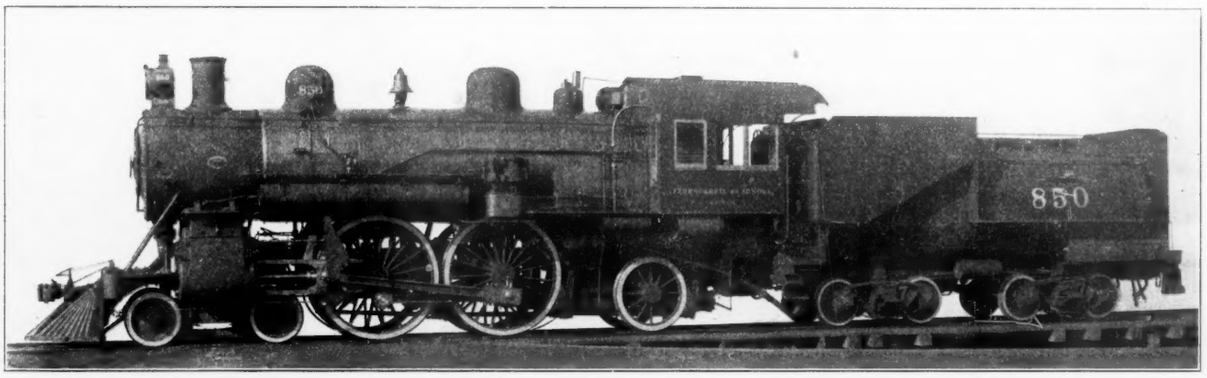
This standardization of the different classes of locomotive equipment of the associated lines was first inaugurated in 1902. At first the specifications covered four types of locomotives; i. e., the Atlantic type passenger, Pacific type passenger, consolidation freight and heavy switchers. Since that time, however, standard designs for ten-wheel and mogul types have also been adopted.

The purpose of thus standardizing the various designs was not only to secure interchangeability of details between locomotives of the same type, but as far as possible, without the sacrifice to the efficiency of the design, to adopt standards, which would be common to all the different types necessary to meet the requirements of the different lines. How well this purpose has been accomplished is shown by a comparison of the designs of the Atlantic and mogul type engines, included in the above-mentioned order and illustrated herewith.

The Atlantic type engines were designed for burning bituminous coal; while of the moguls, 15 are oil burners and the remainder, one of which is shown in the accompanying illustrations, used coal as fuel. Except, for the changes in design incident to the use of oil for fuel, the two classes of moguls are identical in design. The Atlantic type engine had a total weight in working order of 197,000 lbs., of which 100,400 are carried on the drivers, while those of the mogul type have a total weight in working order of 179,200 lbs., with 152,500 on the drivers. It might be mentioned here, in passing, that this weight places these last-mentioned engines among the heaviest of their type ever built, the only moguls having a greater weight, built by the same company, being those for the Vandalia, which weighed 187,000 lbs., and are the heaviest of their class in the world. With the larger diameter driving wheels of the Atlantic type engines, it is possible, however, in spite of the smaller weight on driving wheels of this type, to

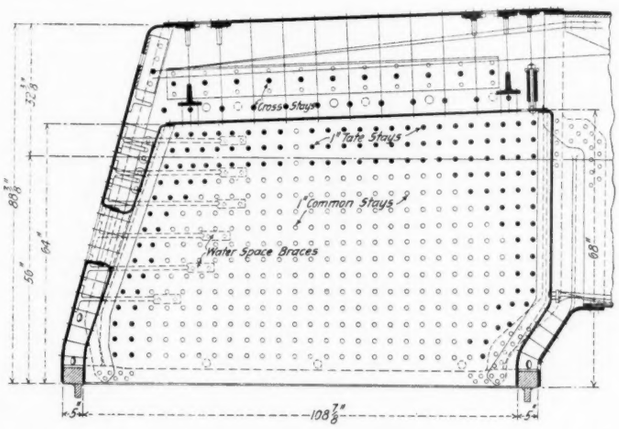
use the same boiler pressure and same size cylinders for both classes of engines.

Each class is equipped with cylinders 20 in. diam., 28 in. stroke, provided with piston valves 12 in. diam. The valves of each type have a maximum travel of 6 in. with 1 in. steam lap and 1-16 in. exhaust clearance and the lead in full gear of 3-32 in. The motion in both cases is indirect, but in the Atlantic type engines the rocker shafts being located ahead of the forward driving wheels, the link is connected with the downward extending arm of the rock shafts by means of a transmission bar which straddles the front axle. As a result of the above, the same cylinder heads, valves, valve bushings, pistons, piston rods, crossheads, connecting rod bearings, rock shafts, eccentric straps and eccentrics are common to both classes of engines. In fact, as far as the valves, valve bushings, crossheads, rock shafts, eccentrics and straps are concerned, these details are also standard for the ten-wheel engines, built by the same company and illustrated in the Sept. 18, 1908, issue of the *Railroad Age Gazette*.



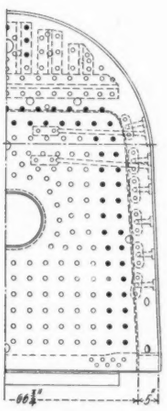
Standard Atlantic Locomotive for the Harriman Lines.

The cylinders of both designs, here illustrated, have the same spread of 88 in. and the same distance, 43 in., between frame centers and take a common frame section, so that the deck plates, reverse shafts and driving boxes are common to the two classes.



Firebox for Standard Atlantic Locomotive for the Harriman Lines.

Both boilers are of the straight top, crown bar type, and have the same diameter and the same inside dimensions of firebox; although in the case of the mogul, the mud ring slopes down at the front end and the throat sheet is vertical, while the mud ring of the Atlantic type is straight and the throat sheet is sloped. There is also a slight difference in the arrangement of the sling stays for the crown sheet, that for the Atlantic locomotive having flat crown bars at the front end, while in the mogul it is an inverted T. In the location of the flexible stay bolts we find general agreement in the two boilers with the small modification in the details of the arrangement required by the difference in the form of the firebox. Still there is enough of a variation to attract attention. For example, in the Atlantic engine the three top rows of side bolts are flexible, while, in the mogul, only the two top rows are flexible. The clusters in the corners are nearly identical and there are two vertical rows at the front and back. The reason for this is that though there is but 5⅜ in. difference in the length of the side sheets, there is also a difference of 5 in. in the depth of the firebox, or approximately the spacing of one horizontal row of stay bolts. So that by putting in three rows of bolts in the Atlantic engine, which has the greater depth, the distance of the lower row of flexible stays from the foundation ring is kept practically the same in both locomotives, or 56 in. and 56¾ in., respectively. The reason for the adoption of this distance is probably based on experience; for, as we have seen before, there is a wide variation in the use of flexible staybolts between roads that are operated in the same territory.



Half Back End of Boiler.

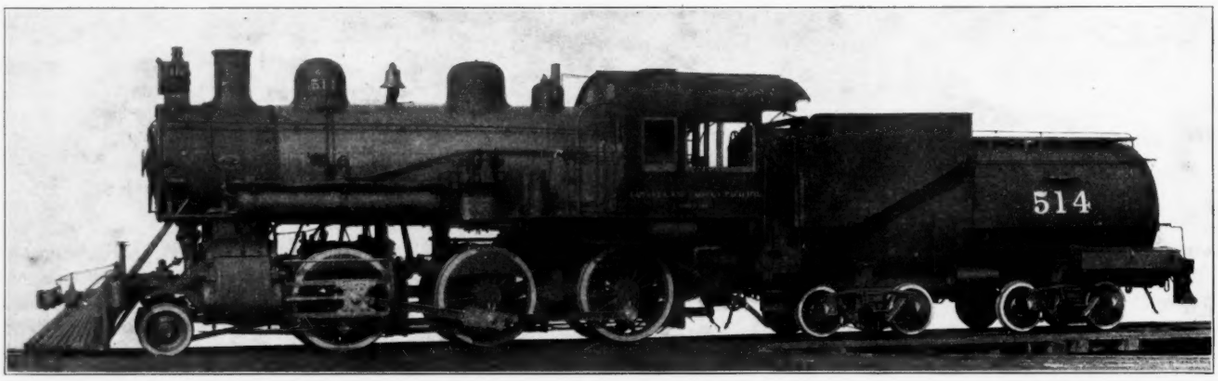
The back head is fitted with the water space braces, that have come into use with the increase in the width of the water leg at the sides. When this width was 4 in. and of nearly uniform dimensions throughout, the whole of its height, the unstayed flat surface in the back head between the side sheet and the first vertical row of stays was not great enough to require special bracing. But with the water space increased to 5 in. at the foundation ring, and widening to 6 in. or more at the crown, there is a flat surface of from 7½ in. to 8½ in. that requires some special support, hence the introduction of these new braces for the water space. Their form is clearly shown in the engraving and they are riveted to the side and back sheets. In the Atlantic engine it will be noticed that there is a break in the top horizontal rows of flexible bolts and that three rigid bolts are introduced. This is to permit of a cab attachment that would interfere with the projection of the flexible head. It is for such places as this that it is especially desirable to have a flexible bolt that will go in flush with the surface of the outside sheet.

With the diameter of the boilers the same for both classes, it is possible to use the same smoke stacks, smoke box—front and door, dome ring base and cap, throttle pipe, dry pipe elbow and end and minor details. At the same time, a comparison of the amount of heating surface in the two designs shows that this standardization of the boiler design has been

effected without any sacrifice of the efficiency of either design for the particular class of service for which it is intended. With the greater length of flue of the Atlantic type, a total heating surface of 2,649 sq. ft. has been obtained as compared with 2,102 sq. ft. of the mogul type. This gives a ratio of tractive power multiplied by the diameter of drivers to total heating surface or, in other words, a B.D. factor of 717 in the passenger engine which, although not as low as in some other recent examples of engine of the same type, is about the average and would indicate the large boiler capacity for sustained high speeds. Some of the other more important details which might be mentioned as common to both classes of engines are steel cabs, sand boxes, injectors, injector checks, throttle levers, engine truck axles, engine truck boxes and grate bars.

Each engine is provided with a Vanderbilt-type tender with a cylindrical tank having a capacity of 7,000 gallons of water and a fuel capacity of 14 tons. The tender frames are of angle irons and the tenders are carried on two four-wheel

$\frac{\text{Weight on drivers}}{\text{Total weight}}$ =	85.10*	50.96*
$\frac{\text{Weight on drivers}}{\text{Tractive effort}}$ =	5.04	4.27
$\frac{\text{Total weight}}{\text{Tractive effort}}$ =	5.90	8.38
$\frac{\text{Tractive effort x diameter drivers}}{\text{Heating surface}}$ =	905.79	711.17
$\frac{\text{Heating surface}}{\text{Grate area}}$ =	42.48	53.51
$\frac{\text{Firebox heating surface}}{\text{Total heating surface}}$ =	6.94*	6.56*
$\frac{\text{Weight on drivers}}{\text{Total heating surface}}$ =	72.55	37.90
$\frac{\text{Total weight}}{\text{Total heating surface}}$ =	85.25	74.36
Displacement of 2 cylinders, cu. ft. =	10.18	

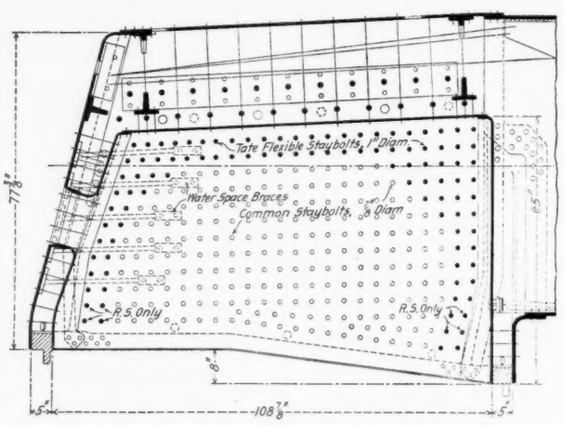


Standard Mogul Locomotive for the Harriman Lines.

trucks of the Andrews cast steel side frame type. Some of the tender details, which are common to both types are as follows: Axles, bolsters, journal boxes, truck center plates, springs, side bearings, wheels, air brakes, tender frame body bolsters, and draft gear.

The following are some of the principal dimensions of these locomotives:

	Mogul.	Atlantic.
Cylinder diameter	20 in.	20 in.
Piston stroke	28 in.	28 "
Wheel base, rigid	15 ft. 2 in.	7 ft.
" " total	24 ft.	27 ft. 7 in.
" " engine and tender	53 ft. 2 11-16 in.	57 ft. 3 11-16 in.
Weight on drivers	152,500 lbs.	100,400 lbs.
" total	179,200 "	197,000 "
" engine and tender	313,000 "	339,380 "
Heating surface, tubes	1,956 sq. ft.	2,475 sq. ft.
" " firebox	146 " "	174 "
" " total	2,102 " "	2,649 "
Grate area	49.5 " "	49.5 "
Journals, driving	9 in. x 12 in.	9 in. x 2 in.
" front truck	6 in. x 10 "	6 " x 10 "
" trailing "		8 " x 12 "
" tender	5½ in. x 10 "	5½ " x 10 "
Steam pressure	200 lbs.	200 lbs.
Firebox, length	108 in.	108 in.
" width	66 "	66 "
" thickness, crown, sides, back	⅜ "	⅜ "
" " tubesheet	½ "	½ "
" water space	5 "	5 "
Tubes type	Shelby seamless	seamless
" material	steel	O.H. steel
" number	297	297
" diameter	2 in.	2 in.
" length	12 ft. 8 "	16 ft. 0 in.
" thickness	.125 "	.125 "
Stack diameter	20 "	20 "
Tank type	cylindrical	cylindrical
" capacity, water	7,000 gals.	7,000 gals.
" " coal	14 tons	14 tons
Tank capacity, oil	2,940 gals.	
Valves type	piston	piston
" travel	6 in.	6 in.
" lap	1 "	1 "
" exhaust clearance	1-16 "	1-16 "
" lead	3-32 "	3-32 "
Wheels, diameter, driving	63 "	81 "
" " front truck	30½ "	33½ "
" " trailing truck		51 "
" " tender	33½ "	33½ "
Tractive effort	30,222 lbs.	23,506 lbs.



Firebox for Standard Mogul Locomotive for the Harriman Lines.

$\frac{\text{Total heating surface}}{\text{Displacement of 2 cylinders}}$ =	206.48	10.18 260.21
$\frac{\text{Grate area}}{\text{Displacement of 2 cylinders}}$ =	14.34	14.34

*Per cent.

The export of locomotives from Germany has been unusually great in 1908, for the first eight months nearly 70 per cent. greater than in 1907. The export statistics give, not the number, but the weight of the exports, which was 308,863 tons this year, with an aggregate value of $8,300,000. More than one-fourth of these exports were to France; while Spain, Brazil and Egypt also were good customers. Italy took more than any other country, but not many more than in 1907.

General News Section.

On the St. Louis & San Francisco a change has been made in the organization of the operating department, and hereafter the seventeen trainmasters will be known as assistant superintendents. The new title will carry with it increased authority and additional duties.

On Saturday, December 19, the Middle division of the Pennsylvania Railroad moved more freight cars than in any other day since the beginning of the depression in business in the fall of 1907. The number of loaded cars passing Denholm, counting the movements in both directions, was 6,857.

The United Traction Co., running street railways in Albany and Troy, replying to complaints of insufficient heat in its cars, says that the electric power, which is supplied by natural water falls, is only barely sufficient to move the cars, leaving none for heat. The long continued drouth has produced a situation which is unprecedented.

The delays to passenger trains in New York State in the month of October, as reported by the Public Service Commission, Second district, averaged 22.9 minutes for each late train. The average delay, based on total number of trains run, was 4.1 minutes. The total number of trains reported was 57,712; per cent. of trains on time at the end of the division, 82.

It is said that the railway companies operating in Indiana will ask for the repeal of the "full crew law" of that state. They point out that a crew of five men is not necessary on an express train, and that the law works a hardship. It is said also that the companies have arranged to keep a close watch on legislation in the next session, especially against labor legislation. The railway labor organizations have appointed a legislative committee also to be present at each session.

On Monday, December 21, the subway and elevated lines of the Interborough Rapid Transit Co., New York City, carried 1,800,000 passengers, which is about 200,000 more than the number carried in the heaviest day of the Christmas season one year ago. The elevated lines carried a slightly smaller volume of traffic this year than last year, but in the subway the movement increased 30 per cent. The extension of the subway from Bowling Green to Brooklyn has largely increased the number of passengers.

The Minnesota Supreme Court on December 24 rendered a decision holding that the Great Northern and the Chicago Great Western must pay a tax of 4 per cent. of gross earnings. The Great Northern contested the present gross earnings tax law upon the grounds that the territorial legislature fixed the tax to be levied upon the roads now composing the Great Northern at 3 per cent. The Chicago Great Western contested the law upon the ground that the original territorial charter fixed its tax at 2 per cent. The court holds that the present statute impairs no contractual or other vested right of the roads and is not repugnant to either the state or Federal constitution.

Surprise tests on the Pennsylvania Railroad in October numbered 22,831. The reports show that in 22,749 cases the employees obeyed the rules to the letter. Of these cases, 3,365 were tests of observance of block signals set in unexpected ways, and the percentage of observance was 99.1. To ascertain the thoroughness with which employees observe emergency signals, such as fusees, torpedoes, etc., 3,357 trains were tested, and in 99.6 per cent. of the cases the rules were obeyed perfectly. The other tests covered cases of trains running ahead of schedule, and signalmen being on hand at the relieving hour. Special attention is being given to the latter subject in order to insure that the men shall obey the eight-hour law implicitly.

The General Managers of the Pennsylvania Lines East and West of Pittsburgh announce that the examinations of applicants for the Frank Thomson scholarships will be held in June, 1909. These scholarships, amounting to $600 a year, were established in 1907 by the three children of the late Frank Thomson. After 1910 there will be eight holders of scholarships, and this number is expected to be maintained in succeeding years. The examination will be open to the sons of some 173,000 men, that is, of all employees of the Pennsylvania and its controlled lines. The College Entrance Examination Board of New York City will conduct the examinations. Applications are to be sent before June 3 to Thomas S. Fiske, Secretary, sub-station No. 84, New York City.

The extension of education for the benefit of farmers is now proceeding at such a rapid pace that it is difficult to keep track even of the names of the different enterprises, to say nothing of describing their nature and extent. The Boll Weevil Special is rapidly succeeded by an expedition for the demonstration of the most suitable methods for the extermination of fruit tree pests. This is to be run on a special train by the state of Pennsylvania, over the Cumberland Valley Railroad. Mr. Surface, State Economic Zoologist, says that instruction on this subject has been carried on for the past two years by demonstrators who have visited the orchards; but evidently the orchards are too numerous and the work has not kept pace with the needs, so now, apparently, the orchards are to be brought to the railroad stations. The lecturers are to give their attention to the orchards in the day time and to the owners at night.

The Attorney-General of Kansas on December 24 filed a petition in the state supreme court for an order to oust the St. Louis & San Francisco from doing business in that state. This company was organized under the laws of Missouri. The petition of the Attorney-General alleges that it has never made any application to the charter board of Kansas for permission to engage in business in the state as a foreign corporation and that no permission has been given to it to engage in business in the state. The capitalization of the company at the time of incorporation in 1896 was $50,000,000 and under the Kansas law it should have paid to the state a charter fee of $25,000. Its capitalization was subsequently increased to $100,000,000 and it is alleged that it then should have paid to the state of Kansas an additional charter fee of $25,000. In 1907 its capital stock was increased to $200,000,000, at which time it is alleged that it should have paid to the state a capitalization fee of $50,000. It is alleged that the road has refused to pay any of these fees and that it therefore has no authority to do business in the state.

Telephone Despatching Without Station Operators.

The arrangements being made for the use of telephones on 123 miles of the Union Pacific—North Platte to Sidney—were briefly noticed in our issue of December 18, page 1600. An officer of the road gives the following details: "The signals to be used at the three 'blind sidings' will be the U. P. standard semaphores, constantly lighted by acetylene gas. There will be two signals at each place, one eastbound and one westbound. They will be operated by the despatcher at North Platte by means of the Gill high-speed selector, the same apparatus that will be used for calling the offices on the line. There will be two station selectors at each blind siding, one to operate the eastbound signal and one to operate the westbound. The Gill selectors are made by the United States Electric Company of New York City. There will be buttons assigned in the calling device for each blind siding, the same as for each office, and the despatcher operates the signals exactly as he calls an office. There will be an answer-back arrangement, so the despatcher will know the semaphore arms have moved. After a conductor, whose train has been stopped, finishes his telephoning with the despatcher, he will put the semaphore at normal, working it from the booth in the same manner that signals are moved by operators at stations.

"The booths will be the U. P. standard, without windows.

They will be lighted by acetylene gas, the light being started automatically as the conductor steps on a mat on the floor of the booth. When doors of booths are opened the telephones will be connected with the line, and this will be disconnected when the doors are closed. The telephones will be placed in iron boxes, which will be locked with switch locks. The keys cannot be taken out of the locks without locking the boxes.

"Egry train-register boxes will also be placed in these booths and supplied with Form 31 train order blanks in roll form, so that conductors can make three copies. The conductor can take out but two copies; one copy must remain in the box to be gathered up at intervals for use in checking the work. These boxes will be equipped with locks, so that neither the train order blanks nor the completed copies can be tampered with.

"The telephone equipment for this line will be furnished by the Western Electric Company of Chicago. The line will be constructed of copper wire weighing 210 lbs. per mile and the two wires forming it will be transposed every 80 rods to provide against interference from telegraph wires on the same poles and from other outside influences."

We understand that the despatchers will be instructed to use these unattended telephones only for extending rights—never for restricting.

Engineers to Visit Panama.

President Roosevelt has invited the following engineers to accompany Mr. Taft on his trip to Panama this month: Arthur P. Davis, Chief Engineer Reclamation Service; John R. Freeman, Providence, R. I.; Allen Hazen, New York; Isham Randolph, Chicago; James Dix Schuyler, Los Angeles, and Frederick P. Stearns, Boston. Mr. Alfred Noble was the first engineer invited by the President, but he was unable to leave his present work. It was on his recommendation that the President selected the above six engineers.

What Next?

A petition has been filed with the New York State Public Service Commission, Second district, by the 19 motormen employed by the Rochester & Eastern, protesting against a recent order requiring the abolition of curtains between the motor-cab and passenger compartments on all the cars.

The main argument for the change is that it will add to the comfort of the passengers by reason of their being able to see the track some distance in advance of the car. The motormen, however, cite instances where serious collisions happened when the approaching danger was seen by the passengers, who were immediately thrown into conditions of great excitement and while standing and walking around the car were seriously injured; whereas, if they had remained quietly in their seats they would not have been hurt.

Inquiry Concerning Railway Discipline in New York.

As a result of investigations of accidents on railways, the New York State Public Service Commission, Second District, has ordered each railway to furnish by February 1 the following papers and information, to wit:

1. Five copies of all printed rules for the operation of its road.

2. A statement showing for each of the following classes of employees engaged in the operation of its road, namely: (a) engineers, (b) firemen, (c) conductors, (d) trainmen, (e) flagmen, (f) brakemen, (g) switch tenders, (h) gatemen at crossings, (i) flagmen at crossings, (j) towermen, (k) telegraph operators, (l) train despatchers, (m) any other employees engaged in operating trains, what examination or inquiry, if any, is made previous to their employment in or promotion to such positions as to their mental and physical capacity, experience and general fitness for the proposed employment.

3. A statement showing what steps are taken to require of each employee a competent knowledge of the operating rules governing his duties and conduct as such employee.

4. A statement showing what examinations or investigations are made from time to time, either regularly or otherwise, to keep informed as to whether employees of the said classes are familiar with the rules and instructions governing their duties and conduct, and what measures are taken to improve the effectiveness of operating rules from time to time and their applicability to disclose accident situations.

5. What record, if any, is kept of violations of rules and instructions by any of the aforesaid employees.

6. Any other information which may, in the opinion of the chief operating officer of each of said corporations, be of use to the commission in investigating the causes of accidents so far as such accidents arise from neglect or non-observance of rules and instructions by employees.

Track Inspection Premiums on Queen & Crescent.

The following premiums have been awarded by the Queen & Crescent as a result of the annual track inspection made on December 15, 16 and 17: For best division between Cincinnati and Meridian, M. J. Connerton, Roadmaster; honorable mention. For best district between Cincinnati and Meridian, L. L. Waters, Supervisor; $75. For best section on Cincinnati division, J. Baker, Foreman, $50; second best, E. Massey, Foreman, $25. For best section on Chattanooga division, J. McCabe, $50; second best, J. Mitchell, $25. For best section Alabama Great Southern, M. Dyer, $50; second best, B. H. Wright, $25. Additional prize for the best section between Cincinnati and Meridian, M. Dyer, $10.

Rule H.

The rule against smoking by trainmen is being rigidly enforced on the E. & A. division of the Pennsylvania. Recently several trainmen living in New Castle were transfered from passenger to freight duty because they were caught smoking. Trainmen caught smoking are liable to immediate discharge.—*Exchange.**

The Universal Fare Ticket.

The Missouri, Kansas & Texas is now using, in place of mileage tickets, similar tickets which represent money instead of miles. Since the reductions in fares ordered by the legislatures of different states last year, the use of mileage tickets has been found inconvenient, if not impracticable, on account of the different rates in different states, and we are informed that the use of tickets representing money has been found a satisfactory substitute. The tickets can be used for the payment of extra baggage charges or storage, or meals in dining cars, or in fact any purpose which the railway company may find desirable. The new tickets are made by the Universal Fare Ticket Co., 305 Equitable building, St. Louis, Mo. The circular of the company shows two forms of ticket—one of 2,000 coupons made good for the bearer, and one of a slightly different form, designed to be issued for the exclusive use of a single person. In form A the coupons are ¼ in. high by about ½ in. wide, and each coupon represents one cent. Crosswise of the ticket there are five coupons and, measuring lengthwise, a length of 2½ in. contains 50 coupons. In the other form, which is like common forms of mileage tickets, each coupon extends entirely across the ticket, and is about ⅛ in. wide.

Railway Employees' and Investors' Association.

The Executive Committee of this Association met in Chicago on Tuesday last and appointed as secretary of the Association C. D. Kellogg, of Cedar Rapids, Iowa, editor of *The Railway Conductor;* and Mr. Morrissey, the president, in conjunction with Mr. Kellogg, will at once begin the active work of organization. A constitution and by-laws have been adopted. Mr. Morrissey proposes to organize the employees

*"A rule which cannot or ought not to be enforced, ought not to exist."—*From an Ancient Edition of the Standard Code.*

of each road; then to form state organizations of the employees of each road, to be followed by state organizations of the employees of all the roads in each state. All railway employees will be asked to become members. Mr. Morrissey thinks that the organization can be supported by a small membership fee.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; June, 1909.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—R. W. Pope, 33 West 39th St., New York; second Friday in month; New York.
AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Pl., New York; May, 1909; New York.
AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—S. F. Patterson, B. & M., Concord, N. H.; Oct. 19, 1909; Jacksonville, Fla.
AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASSOC.—E. H. Fritch, Monadnock Bldg., Chicago; March 16-18, 1909; Chicago.
AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 16-18, 1909; Atlantic City.
AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and Aug.; New York.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York; Jan. 12, 1909; New York.
AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—B. V. Swenson, 29 W. 39th St., New York.
ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; April 28, 1909; Cincinnati.
ASSOCIATION OF RAILWAY CLAIM AGENTS.—C. L. Young, C. & N.-W. Ry., Chicago, Ill.; May, 1909; Detroit, Mich.
ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Wisconsin Central Ry., Chicago; June 23-25, 1909; Detroit.
ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Pl., New York.
CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.
CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; January; Montreal.
CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.
FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Richmond, Va.; June 16, 1909; Old Point Comfort, Va.
INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 62 Liberty St., New York; May, 1909; Louisville, Ky.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; June, 1909.
IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Iowa; 2d Friday in month, except July and August; Des Moines.
MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 21-23, 1909; Atlantic City.
NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in month, ex. June, July, Aug. and Sept.; Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.
NORTH-WEST RAILWAY CLUB.—T. W. Flannagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, Aug.; St. Paul and Minn.
RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June, July and August; Pittsburgh.
RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.; March 15, 1909; Chicago.
ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Nov., 1909; Washington.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
SOUTHERN AND SOUTHWESTERN RY. CLUB.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs. Jan., April, Aug. and Nov.; Atlanta.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R. R.R., East Buffalo, N. Y.; September, 1909; Denver.
WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month, except June, July and August; Chicago.
WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Bldg., Chicago; 1st Wednesday, except July and August; Chicago.

International Railway General Foremen's Convention.

The annual convention of the International Railway General Foremen's Association will be held in Chicago in May, 1909. C. E. Cook, Royal Insurance building, Chicago, is Secretary.

Traffic Club of Chicago.

The monthly meeting of the Traffic Club of Chicago will be held at the Grand Pacific hotel on January 5 at 12:30 o'clock p. m. The speaker will be Arthur Hale, Chairman of the Committee on Car Efficiency.

American Society of Mechanical Engineers.

The next monthly meeting will be held in the Engineering Societies building, New York, on Tuesday evening, January 12. The paper will be by Carl G. Barth, of Philadelphia, Pa., on "The Transmission of Power by Leather Belting," illustrated by lantern slides. It will be a summing up of the theory and practice of belting, in which conclusions are drawn from the work of Lewis, Bancroft, Bird and others, who have made experiments on the transmission of power by belting. Charts have been prepared by the author for the solution of belting problems.

Traffic News.

The Ohio Supreme Court in a decision on December 23 upheld the validity of the law passed by the legislature last winter authorizing railways to collect a penalty of 10 cents from passengers who pay fares on trains.

During the months of January and February Canadian Pacific trains No. 1 and No. 2 will not run between Montreal and Winnipeg, nor between Calgary and Vancouver. Trains 96 and 97 will continue to run through between Montreal and Vancouver.

In the United States Circuit Court at New York Dec. 23, Hammacher, Schlemmer & Co. pleaded guilty to having shipped piano tuning pins as "iron screws," and to securing a lower rate thereby. The defendant was fined $500 on each offense in the indictment.

The Supreme Court of Mississippi, in a recent decision, reaffirms a former decision to the effect that if a railway charges demurrage on freight cars delayed by consignees, it must be held liable for a similar charge when it fails to deliver goods on time.

The British ship Conway left Gulfport, Miss., last week loaded with 11,000 bales of cotton, 200 tons of cottonseed meal and other freight, for England and France. This is the first shipment of Mississippi cotton made directly from a Mississippi port. The freight was carried to Gulfport by the Gulf & Ship Island.

The western railways have decided to keep their freight houses in Chicago open daily hereafter until 5.30 p.m. Some months ago the Chicago lines all agreed to close their freight houses at 5 o'clock, but shippers protested and the time of closing was made 5.15 p.m. This hour of closing did not prove satisfactory to the western roads.

The Atchison, Topeka & Santa Fe has been cited for contempt by the Oklahoma Corporation Commission for alleged violation of the Commission's milling-in-transit and demurrage orders. The Chicago, Rock Island & Pacific has been cited for contempt for an alleged violation of the demurrage order. In the Rock Island case it is charged that the road was ten days in hauling a car of freight from Oklahoma City to Watonga, 50 miles.

J. L. Bennett has been appointed by the United States Circuit Court at Chicago a special master in chancery to take testimony in the Missouri river jobbers' case. This is the suit begun by the railways running from the Mississippi to the Missouri river to contest the order of the Interstate Commerce Commission requiring the reduction of the Mississippi-Missouri proportionals of through class rates from the Atlantic seaboard to Missouri river points.

In the United States District Court at Trenton, N. J., Dec. 21, a preliminary injunction was granted restraining Jacob L. Simon, Joseph Abrams, Michael Uslander and Thomas Morgan, all of Paterson, from selling non-transferable commutation tickets on the Erie Railroad for passage between New York and Paterson. The railway says that it loses large sums annually by this practice, the "brokers" lending the tickets for use by individuals for single rides.

At Little Rock, Ark., on Monday last, T. H. Bunch, a grain dealer, was fined $15,000 for accepting rebates from the Iron Mountain railroad. The defendant pleaded guilty in three cases, and the fine assessed by the court was $5,000 in each case. Similar indictments are pending against the railway company and its former traffic manager. Bunch was indicted last April by the United States grand jury for the Eastern district of Arkansas. The indictment charged him with receiving rebates on shipments of grain transported from Kan-

sas City to Little Rock. It is also charged that he received elevation allowances in violation of the act.

The Southern Pacific Terminal Company, the Galveston, Harrisburg & San Antonio and the Southern Pacific have applied to the Federal court at Galveston, Tex., for an injunction to restrain the Interstate Commerce Commission from enforcing its order prohibiting the Southern Pacific Terminal Company from giving E. H. Young exclusive use of its wharf at Galveston. Complaint was made by Carl Eichenberg against the exclusive privilege given to Young and the Commission held that the discrimination in favor of Young was illegal. On December 18 a demurrer filed by the Commission was overruled, and the Commission was given 15 days to answer the petition of the complainants upon its merits.

The Interstate Commerce Commission, which is engaged in making a list, as complete as possible, of all the private railways in the country, finds in Massachusetts 32 different concerns, though in the cases of 18 of them there is no information as to the length of track. Of those for which mileage is given there are the American Steel & Wire Company, 7 miles; Cape Ann Granite, 2 miles; Fore River, 10 miles; Granite Railway, 5 miles; Keith Car & Manufacturing Company, 7 miles; Milford Pink Granite Quarry, 9 miles. The total mileage recorded is 47.8 miles. In addition to these the Boston Terminal Company, 3.6 miles; Boston Wharf Company, — miles, and the Union Freight Railroad (Boston), 2.3 miles, are reported in a separate class.

According to a press despatch from San Francisco, December 29, one hundred mass meetings were held in California on Tuesday last to protest against the proposed increase in transcontinental freight rates which has been announced to go into effect January 1. These remonstrances against the action of the railways have been managed by an executive committee said to have been appointed by the shippers of the state. Every important city in the state held a meeting, and the speakers declared that the railways are guilty of the imposition of a $10,000,000 annual tax on California consumers, that being the estimated difference between the rates now in force and those which the companies seek to collect after the first of the year. As to the names of the authorities who made this "estimate," and the data on which it is based, the despatch gives no information.

A federal grand jury at Chicago has been investigating the relations between certain packing concerns at Chicago and the railways. Much secrecy has been observed regarding both the offense suspected and the persons against whom the inquiry is directed. Numerous reports have been put in circulation connecting various railways and concerns with the investigation, but the only facts that have become known are that several officers and employees of Nelson Morris & Co., Chicago packers, have been subpoenaed as witnesses and that papers relating to loss and damage claims have been taken from the files of some of the railways by representatives of the government. The impression among railway officers is that the government suspects violations of the Interstate Commerce Act and having little specific evidence to work upon has thrown out a dragnet to see what it can get.

The Cleveland, Cincinnati, Chicago & St. Louis has brought suit in the superior court at Indianapolis, Ind., to restrain the Indiana Railroad Commission from enforcing an order requiring it to deliver freight in carloads to the Winona Interurban Railway and the Spencer & Hogan Company, of Warsaw, Kosciusko county. The Big Four says there is no ordinance allowing the interurban company to unload freight cars in the streets of Warsaw. It also sets up that it is a member of the American Railway Association, whose members have a mutual interest in the exchange of freight, each paying a daily rate of 25 cents a car for other companies, and who have a mutual arrangement for the repair of cars. The Winona Interurban, not being a party to this arrangement, the Big Four claims it would be illegal for it to interchange freight with it without a corresponding arrangement. The Big Four also attacks the order upon the grounds that the law creating the Commission is unconstitutional in that it unites legislative, judicial and administrative functions and that if the order were enforced it would interfere with interstate traffic and deprive the steam road of its property without due process of law.

A conference between California shippers and the railways regarding the advances in transcontinental freight rates was held at San Francisco Dec. 16. The shippers presented general arguments against any advance in freight rates whatever. An interesting feature of the controversy over the advance in rates to the Pacific coast is that while the coast shippers are opposing the advances, shippers at inland points, such as Spokane and Salt Lake City, are taking the side of the railways and contending that the advances are reasonable. F. H. McCune in the Carson City (Nev.) *News* says that the development of Utah, Nevada and other inland states would in the long run inure to the benefit of San Francisco, but that the business men of San Francisco shortsightedly seek advantages in transportation which have the effect of preventing the development of inland territory.

O.H.—B.O.—S.L.&C.—O.R.—K.D.

Two prize hogs, valued at $2,000, are confined in a pen at the Wabash Railroad stock yards, Peru, Ind., and have been there for more than a year as the result of a controversy. The two hogs, with another equally valuable, were purchased from a man in Missouri by John H. Miller, a well-known stock breeder and exporter. In the purchase agreement it was stipulated that the hogs should reach Peru on or before a certain date, at which time Mr. Miller was to make a shipment of live stock to Buenos Ayres, Argentina, but the hogs came a day after Mr. Miller had left with his stock.

The Wabash took possession of them and reported to the shipper, who called on the Missouri Pacific for damages. The road refused to settle. The claim agents for the two companies have held frequent conferences, but the matter still remains open. In the meantime one hog valued at $1,000 has died, and more than $200 worth of feed has been eaten by the two remaining.—*Indianapolis News.*

Obstacles to Chicago's Shipping Development.

George C. Sikes has made a report to the Chicago Harbor Commission in which he discusses obstacles to Chicago's water shipping development. Lack of direct street car connections with docks is a main obstacle to the development of passenger boat business at Chicago. Where a boat takes goods from a railway in Chicago it pays 14 cents a ton for unloading the car, a usage that prevails at no other port on the lakes. Chicago river must serve as the harbor for a number of years to come and it is recommended that all the remaining center pier bridges be replaced by bascule bridges. Another suggestion made is that a few piers be built projecting into the lake north of the mouth of the river. Mr. Sikes thinks that the railways have adjusted their lake and rail rates so as to practically shut out independent boat competition for package freight. Having become masters of the package freight business between Chicago and the seaboard, the railways, he says, now appear to be seeking control of the grain movement east. Chicago is not a vessel owning city. Aside from harbor improvement, about all the public can do to encourage home ownership of shipping is to provide more liberal tax laws and to enact incorporation laws designed to meet the needs of boat companies. Mr. Sikes suggests inquiry into the railway terminals in Chicago, which are badly arranged and unsatisfactory.

STATE COMMISSIONS.

The Railroad Commission of Louisiana has ordered all steam boats operating in the state to meet the rail rates within the state where such rates are lower than the steam boats rates. The steam boats are allowed, however, to charge in addition the actual cost of insurance of the freight. Rates between intermediate landings and from towns and cities to landings where no actual rail line competition exists need not be reduced on account of short line rail competition.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF OCTOBER, 1908.

(See also issues of December 11, 18 and 25.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations. net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
		Freight.	Passenger.	Total, inc. misc.	Maintenance Way and structures.	Maintenance Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama & Vicksburg	143	$104,716	$37,570	$151,446	$20,044	$32,530	$3,115	$43,170	$4,572	$103,431	$48,015	$349*	$3,600	$44,066	$5,423
Alabama Great Southern	309	214,188	69,731	314,478	51,139	58,768	7,593	94,898	9,566	221,964	92,514	631*	11,490	80,393	23,043
Belt Ry. Co. of Chicago	21	.....	.....	176,541	8,216	19,543	.....	67,199	5,638	100,596	75,945	.....	5,750	70,195	‡19,176
Bessemer & Lake Erie	201	726,977	23,744	756,211	66,963	105,033	5,458	170,422	6,517	354,393	401,818	.....	4,000	397,818	61,002
Central New England	294	206,203	31,345	249,926	50,051	23,415	2,693	80,801	3,859	160,819	89,107	.....	5,600	83,507	48,045
Charleston & Wn. North Car	340	116,330	21,813	144,764	21,383	20,702	2,238	49,997	3,476	97,796	46,968	.....	4,100	42,868	15,634
Chicago, Peoria & St. Louis	255	115,458	33,474	156,518	22,645	30,029	6,040	57,912	4,831	121,457	35,061	.....	4,600	30,461	‡4,028
Cincinnati, New Orleans & Tex. Pacific	337	517,454	117,513	665,790	91,391	128,092	16,479	201,064	18,601	455,627	210,163	3,691*	19,642	186,830	15,872
Cleveland, Akron & Columbus	210	129,696	36,286	179,836	24,402	26,107	2,324	57,218	2,781	112,832	67,004	.....	7,000	60,004	12,176
Cleveland, Lorain & Wheeling	194	353,999	18,890	396,870	33,793	64,097	5,984	113,359	6,367	223,600	173,270	.....	9,406	163,864	‡32,004
Colorado Midland	338	147,978	32,175	207,684	31,426	27,795	9,858	85,669	5,688	160,436	47,248	390*	8,400	38,458	‡19,819
Cumberland Valley	162	158,446	55,800	225,259	25,332	22,617	4,137	71,615	4,682	128,383	96,876	600	3,713	93,763	‡17,481
Detroit, Grand Haven & Milwaukee	191	97,274	45,306	165,913	30,614	14,849	4,770	63,744	3,307	117,284	48,629	56*	2,711	45,862	23,835
Elgin, Joliet & Eastern	239	211,016	55	218,929	23,274	33,587	2,692	69,903	6,336	135,792	83,137	.....	9,500	73,637	‡17,562
Evansville & Terre Haute	310	123,752	52,252	196,323	31,709	24,468	5,075	58,048	6,182	125,482	70,841	313*	9,035	61,493	‡3,285
Georgia	307	224,498	63,512	306,889	53,323	36,155	7,499	110,158	6,651	213,786	93,103	.....	1,625	91,478	‡15,605
Georgia Southern & Florida	395	100,525	50,394	169,107	12,812	46,051	5,019	57,042	8,585	129,509	39,598	1,310	7,552	33,356	6,657
Grand Trunk Western in U. S.	336	332,656	148,419	506,698	54,310	58,297	22,428	183,201	10,210	328,446	178,252	689*	32,000	145,563	98,080
Gulf & Ship Island	307	135,387	30,500	176,088	33,950	25,168	1,450	54,886	7,106	122,560	53,528	.....	3,685	49,843	11,075
Indiana Harbor Belt	103	126,180	.....	129,522	31,709	13,753	1,520	80,26..	4,594	131,839	2,317*	6,790	3,136	1,337	‡17,502
Kanawha & Michigan	177	194,803	29,451	228,584	37,472	50,671	2,189	66,673	2,308	159,313	69,271	27*	6,600	62,644	46,321
Lehigh & Hudson River	97	122,939	4,329	129,749	19,739	9,312	884	47,912	3,472	81,319	48,430	.....	2,500	45,930	25,805
Louisiana Western	198	124,015	42,913	174,851	14,333	21,429	4,255	47,909	6,474	94,400	80,451	549	4,925	76,075	‡633
New Orleans & North Eastern	196	208,036	44,450	269,638	32,550	46,605	7,473	86,934	9,446	183,008	86,630	293*	6,750	79,587	6,137
New York, Philadelphia & Norfolk	112	198,296	29,824	242,940	20,221	44,231	4,304	86,673	11,254	166,683	76,257	.....	6,215	70,042	‡20,774
New York, Susquehanna & Western	151	152,696	50,572	227,136	26,889	23,404	1,803	78,996	4,177	135,269	91,867	2,670	15,089	79,448	‡12,781
Peoria & Eastern	352	174,485	59,736	258,873	31,653	46,645	4,641	98,763	4,122	185,824	73,049	.....	9,505	63,544	‡78,044
Pittsburgh & Lake Erie	191	1,057,520	103,055	1,190,966	123,847	107,852	13,097	251,340	28,349	524,485	666,481	226*	17,500	648,755	‡200,961
Richmond, Fredericksburg & Potomac	83	82,204	53,458	151,220	14,761	24,578	2,374	49,828	4,243	95,784	55,436	.....	200	55,236	5,686
Rutland	468	157,950	92,895	275,560	38,328	37,229	6,487	112,657	6,317	201,018	74,542	.....	11,993	62,549	‡12,476
St. Joseph & Grand Island	319	117,990	35,196	165,173	23,500	14,232	5,045	49,970	4,091	96,838	68,335	2,168*	722	65,445	15,175
St. Louis Merchants' Bridge Term	9	.....	4,728	131,029	19,133	8,068	219	48,340	3,946	79,706	51,323	.....	4,300	47,023	‡20,426
Terminal R. R. Ass'n of St. Louis	26	.....	275	229,568	25,313	15,405	394	60,705	5,102	106,919	122,649	14,130	21,000	115,780	‡8,580
Texas Central	268	93,054	32,560	132,125	14,042	14,978	982	39,557	5,005	74,564	57,561	.....	1,969	55,592	8,178
Trinity & Brazos Valley	455	218,841	18,008	240,105	33,371	25,910	5,179	94,807	12,925	172,192	67,913	.....	2,000	65,913	57,623
Union R. R. (Pittsburgh)	31	.....	.....	305,149	34,220	40,180	100	90,400	2,697	167,597	137,552	520	3,500	134,572	33,513
FOUR MONTHS OF FISCAL YEAR.															
Alabama & Vicksburg	143	$308,430	$152,250	$494,752	$83,200	$105,518	$12,718	$167,303	$19,175	$387,914	$106,838	$1,844	$14,400	$90,594	‡$19,231
Alabama Great Southern	309	740,217	349,577	1,199,071	153,234	241,031	29,846	394,585	35,285	853,981	345,090	1,904*	45,838	297,348	58,317
Belt Ry. Co. of Chicago	21	.....	.....	649,350	38,344	64,852	.....	233,559	24,518	361,273	288,077	.....	23,000	265,077	‡57,508
Bessemer & Lake Erie	201	2,663,224	133,445	2,818,586	240,947	411,999	21,516	654,953	25,624	1,355,039	1,463,547	.....	16,000	1,447,547	‡34,240
Central New England	294	609,846	133,517	788,496	162,131	86,997	6,828	258,678	11,173	525,807	262,689	.....	22,400	240,289	162,706
Charleston & Wn. North Car	340	318,628	91,782	442,163	87,504	60,982	9,353	161,431	13,154	332,424	109,739	.....	16,400	93,339	59,008
Chicago, Peoria & St. Louis	255	397,347	132,827	556,410	80,058	127,118	24,012	208,613	17,987	457,788	98,622	.....	18,400	80,222	‡2,917
Cincinnati, New Orleans & Tex. Pacific	337	1,992,134	492,373	2,617,649	312,070	560,986	64,520	773,794	68,405	1,779,775	837,874	9,016*	78,568	750,290	102,325
Cleveland, Akron & Columbus	210	462,701	170,349	684,290	91,723	113,866	9,680	208,670	12,149	436,088	248,202	.....	26,000	222,202	‡10,168
Cleveland, Lorain & Wheeling	194	1,434,549	87,099	1,630,397	143,850	267,543	24,364	487,501	23,312	946,570	683,827	.....	37,626	646,201	‡145,639
Colorado Midland	338	557,737	162,903	808,711	116,717	101,022	38,864	319,092	23,605	599,300	209,411	151*	33,600	175,660	‡42,378
Cumberland Valley	162	609,193	219,235	868,165	94,534	77,983	15,447	258,187	21,116	467,267	400,898	2,739	14,852	388,785	‡53,757
Detroit, Grand Haven & Milwaukee	191	333,782	227,794	646,471	113,297	56,083	18,858	239,431	20,358	448,027	198,444	66	10,846	187,664	57,599
Elgin, Joliet & Eastern	239	798,201	174	830,240	89,899	136,184	9,654	249,935	25,129	510,801	319,439	.....	38,000	281,439	‡73,990
Evansville & Terre Haute	310	486,107	217,388	777,981	113,882	93,983	14,108	222,783	24,386	469,142	308,839	1,113*	36,140	271,586	16,234
Georgia	307	666,134	263,890	987,699	214,696	145,641	32,154	396,766	27,220	816,477	171,222	.....	6,500	164,722	‡52,398
Georgia Southern & Florida	395	342,775	204,175	617,869	40,169	115,624	20,120	224,262	34,982	435,157	182,712	5,828	30,206	158,334	61,769
Grand Trunk Western in U. S.	336	1,197,069	674,355	1,975,510	173,175	290,098	87,703	688,249	55,291	1,294,516	680,994	1,843*	128,000	551,151	196,208
Gulf & Ship Island	307	434,373	122,213	590,677	130,650	100,207	5,818	206,566	28,284	471,525	119,152	.....	14,740	104,412	‡89,424
Indiana Harbor Belt	103	468,141	.....	481,069	103,566	48,114	5,947	266,557	20,195	444,379	36,690	9,490	11,498	34,682	‡45,810
Kanawha & Michigan	177	708,232	121,293	846,845	139,956	195,901	8,986	240,505	10,609	595,957	250,888	59*	25,779	225,049	142,010
Lehigh & Hudson River	97	336,626	20,540	367,176	70,610	39,096	3,839	133,152	12,181	258,878	108,298	.....	10,000	98,298	45,047
Louisiana Western	198	411,085	168,736	609,598	58,124	82,597	18,518	178,304	25,416	362,959	246,639	2,126	19,700	229,066	‡1,601
New Orleans & North Eastern	196	688,288	180,148	926,209	98,982	176,999	29,773	310,007	37,771	653,532	272,678	736*	27,000	244,942	‡26,280
New York, Philadelphia & Norfolk	112	753,773	143,908	963,051	76,763	161,834	12,867	336,871	46,793	635,128	327,923	.....	24,860	303,063	‡134,318
New York, Susquehanna & Western	151	519,589	219,498	828,669	110,176	85,555	5,727	290,711	15,710	507,879	320,790	8,901*	29,303	282,586	20,271
Peoria & Eastern	352	634,522	256,128	974,424	130,541	134,160	20,989	360,772	16,947	663,409	311,015	.....	32,419	278,596	‡57,469
Pittsburgh & Lake Erie	191	3,826,881	452,973	4,404,318	502,148	375,537	50,225	942,771	87,497	1,958,178	2,446,140	1,133*	70,000	2,375,006	‡919,393
Richmond, Fredericksburg & Potomac	83	318,720	187,471	569,544	67,951	93,181	8,077	209,211	16,841	395,261	174,283	.....	800	173,483	‡37,091
Rutland	468	535,716	431,261	1,072,062	151,527	126,867	25,590	385,514	23,112	712,611	359,451	.....	36,107	323,344	27,071
St. Joseph & Grand Island	319	405,583	146,718	599,939	84,472	57,517	20,676	178,792	14,976	356,433	243,506	489	21,038	222,957	‡16,561
St. Louis Merchants' Bridge Term	9	.....	14,131	448,220	72,385	21,684	868	173,050	13,834	281,821	166,399	.....	18,633	147,766	‡61,962
Terminal R. R. Ass'n of St. Louis	26	.....	982	796,102	75,581	54,317	1,561	237,388	22,533	391,380	404,722	50,663	86,738	368,647	‡35,765
Texas Central	268	206,747	145,784	375,949	43,789	54,582	3,844	139,258	14,664	256,137	119,812	.....	8,016	111,796	‡15,053
Trinity & Brazos Valley	455	489,213	57,755	558,216	118,504	93,777	16,965	281,224	40,714	551,184	7,032	.....	8,000	968†	49,020
Union R. R. (Pittsburgh)	31	.....	.....	1,194,491	134,031	157,658	400	342,006	9,835	643,930	550,561	2,459*	14,000	534,102	16,182

*Deficit. †Loss. ‡Decrease.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

C. T. Carson has been appointed Auditor of the Chihuahua & Pacific, with office at Chihuahua, Mex., succeeding Philip Baber, resigned

C. B. Hibbard, formerly General Manager of the Quebec, Montreal & Southern, has been elected Second Vice-President of the Quebec Eastern.

W. F. Every, Chief Clerk in the Claim Department of the Northern Pacific, has been appointed General Claim Agent, succeeding J. F. Newton, resigned.

N. M. Osborne, General Agent of the Norfolk & Western, at Norfolk, Va., has been appointed Resident Assistant to the President, with office at Norfolk, Va.

B. L. Birkholz, Eastern Agent of the El Paso & Southwestern, at New York, has been appointed Assistant to the Secretary. The office of Eastern Agent has been abolished.

C. L. Addison, Vice-President of the New York & Long Island Traction Co. and the Long Island Electric Railway, has been elected President, succeeding F. L. Fuller, resigned. William O. Wood succeeds Mr. Addison as Vice-President and Mr. Fuller as a Director. Alfred A. Gardner has been appointed Counsel, succeeding Van Vechten Veeder, resigned.

J. T. Long has been elected President of the Williamsville, Greenville & St. Louis, succeeding D. H. Glass, elected Treasurer. James W. Van Dolah has been elected First Vice-President; D. N. Holladay, Second Vice-President; C. P. Scrogins, Secretary; W. H. Betts, Comptroller; Harris Kobey, Auditor, succeeding H. H. Rhodes, and James A. Plotner, General Counsel.

W. D. Herring, whose appointment as General Claim Agent of the Houston & Texas Central, the Houston, East & West Texas and the Houston & Shreveport, has been announced in these columns, was born in 1848, at Waco, Tex. He began railway work as personal injury Claim Agent for the Houston & Texas Central in October, 1896. In June, 1903, he was appointed General Claim Agent for the Galveston, Harrisburg & San Antonio and the Texas & New Orleans, which position he held until his recent appointment. Prior to the time Mr. Herring was connected with railway work, he was a clerk in his father's law office, and during that time studied law.

Operating Officers.

W. N. Mitchell has been appointed General Manager of the Williamsville, Greenville & St. Louis, succeeding C. A. Long.

H. P. Greenough, Superintendent of the Chicago, Rock Island & Pacific, at Dalhart, Tex., has been appointed Superintendent at Des Moines, Iowa, succeeding C. W. Jones.

R. Beeth, Chief Train Despatcher of the Atchison, Topeka & Santa Fe at Dodge City, Kan., has been appointed Trainmaster of the El Paso & Southwestern at Tucumcari, N. Mex.

E. M. Graham, Agent of the Norfolk & Western at Norfolk, Va., has been appointed General Agent and Superintendent of Terminals at Norfolk, succeeding N. M. Osborne, transferred to another department. E. O. Parkinson succeeds Mr. Graham.

Ernest R. Bissell, Superintendent of the Lake Erie & Western at Muncie, Ind., has been appointed Superintendent of the Peoria division, with office at Lafayette, Ind., succeeding William J. Davis, resigned. J. W. O'Brien, Trainmaster at Lima, Ohio, succeeds Mr. Bissell.

G. C. McNally has been appointed Superintendent of Car Service of the Chicago, Lake Shore & Eastern and the Elgin, Joliet & Eastern, with office at Joliet, Ill. A. M. McClary, Car Accountant, has been assigned to other duties, and his office has been abolished. All reports formerly made to the Car Accountant will be made in the future to the Superintendent of Car Service, who will also have charge of car mileage accounts and settlements with other roads for car mileage.

H. J. Temple, Superintendent of the Cananea, Yaqui River & Pacific, has been appointed Superintendent of the Sonora Railway, with office at Nogales, Sonora, Mex., succeeding A. R. Oster, who will have jurisdiction over the operated lines of the Cananea, Yaqui River & Pacific and Southern Pacific in Mexico, from Empalme south. The line between Zorillo and del Rio has been placed in operation, and the entire line of the Cananea, Yaqui River & Pacific from Lomas Junction to del Rio has become a part of the Cananea division, and will be under the jurisdiction of Mr. Temple.

Arthur Hale is henceforth to devote all his time to the work of the American Railway Association, and he has resigned his position as General Superintendent of Transportation of the Baltimore & Ohio. He will have an office in New York and also one in Chicago. In addition to the duties Mr. Hale has heretofore performed as Chairman of the Committee on Car Efficiency, the Committee on Car Service and the Arbitration Committee, he has recently been representing the Executive Committee of the Association in various matters. His first work in this direction was in connection with the National Conservation Congress in Washington some weeks since. In thus employing Mr. Hale the Association takes the first step—foreshadowed in the special committee report on organization, made last April—in the policy of dealing with the public, and with all questions which immediately affect the public, in a broad, public spirited and impartial manner. And Mr. Hale is eminently fitted for such work. He will be independent of any single railway or group of railways and therefore will be able to deal with the public with all necessary freedom and frankness. He not only has clear conceptions of his work but knows how to clarify other people's ideas concerning railway problems. His reputation for independence of character and as a vigorous worker is already established.

Arthur Hale.

Mr. Hale is the son of Rev. Dr. Edward Everett Hale and was born in 1859. He graduated from Harvard University in 1880, and began railway work in 1882 as apprentice in the Altoona shops of the Pennsylvania. Two years later he became draftsman in the Motive Power department, and in 1885 was made a clerk in the Transportation department at Philadelphia. After two years he was promoted to assistant chief clerk in the Car Record office, and by 1889 had become chief clerk. In 1893 he was made special agent, Transportation department, and in 1898 was made Superintendent of Telegraph. In June, 1901, he left the Pennsylvania to become Assistant General Manager of the Baltimore & Ohio, and a year later was made General Superintendent of Transportation. He has been chairman of the Committee on Car Service of the American Railway Association since 1902, and when the committee on car efficiency was formed about two years ago he was elected chairman of that also.

Traffic Officers.

R. J. Tozer has been appointed Traveling Freight Agent of the Northern Pacific, with office at St. Louis, Mo.

W. L. Jacquith has been appointed Contracting Freight Agent of the Yazoo & Mississippi Valley at Vicksburg, Miss.

Philip A. Hutchins has been appointed General Freight and Passenger Agent of the Chihuahua & Pacific, with office at Chihuahua, Mex.

J. A. Chilton, Traveling Passenger Agent of the New Orleans & Northeastern, the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific, at Dallas, Tex., has been

appointed Traveling Passenger Agent of the Texas & Pacific. Irvin Keller succeeds Mr. Chilton.

A. P. Bryant has been appointed Assistant General Freight Agent of the Minneapolis & St. Louis and the Iowa Central, with office at Peoria, Ill.

R. H. Ingle has been elected a Commissioner of the Montana Demurrage Bureau, succeeding J. D. Mendenhall, resigned on account of ill health.

The jurisdiction of F. C. Lang, Traveling Agent of the Chicago, St. Paul, Minneapolis & Omaha, at Grand Forks, N. Dak., has been extended to include Rainy River, Ont.

The office of Eastern Agent of the El Paso & Southwestern has been abolished and B. L. Birkholtz, heretofore Eastern Agent, has been transferred to another department.

Frank E. Batturs, General Passenger Agent of the Morgan's Louisiana & Texas, has been appointed Assistant General Passenger Agent of the Southern Pacific at San Francisco, Cal., succeeding Paul Shoup, resigned.

J. G. Van Norsdall has been appointed Traveling Passenger Agent of the Pere Marquette at Chicago, succeeding John A. Russell, resigned, and George G. Haight has been appointed Traveling Passenger Agent at Chicago, succeeding John J. Forster, resigned.

E. W. De Hoe has been appointed General Freight and Passenger Agent of the Williamsville, Greenville & St. Louis. H. B. Montgomery, Vice-President, has been given charge of the Land Department and B. F. Funk has been appointed Industrial Agent.

Engineering and Rolling Stock Officers.

O. D. Greenwalt has been appointed Master Mechanic of the Williamsville, Greenville & St. Louis.

James McBrian has been appointed District Car Inspector, Choctaw district, of the Chicago, Rock Island & Pacific, with office at Argenta, Ark.

W. A. Bennett is now Road Foreman of Engines of the Chicago, Burlington & Quincy at Edgemont, S. Dak., with jurisdiction over the line from Alliance, S. Dak., to Deadwood, and over all branches in the Black Hills.

J. F. Bowden, Master Mechanic of the Baltimore & Ohio, at Parkersburg, W. Va., has been appointed Master Mechanic of the Chicago division, with office at Garrett, Ind., succeeding D. Gallaudet, resigned to take service with another road.

Lincoln Bush, whose resignation as Chief Engineer of the Delaware, Lackawanna & Western we have announced, will, on January 1, engage in private practice as Consulting Engineer, with office in the Metropolitan Life building, New York.

D. Gallaudet, Master Mechanic of the Chicago division of the Baltimore & Ohio, has been appointed Master Mechanic of the Grand Junction Terminal of the Denver & Rio Grande, with jurisdiction over the Second district, Second division; also that portion of the Second district of the Third division between Grand Junction, Somerset and Montrose, with office at Grand Junction, Colo.

Purchasing Officers.

V. T. Bartram, Purchasing Agent of the Temiskaming & Northern Ontario, has resigned.

Vandyke Pearson has been appointed Purchasing Agent of the Williamsville, Greenville & St. Louis, succeeding D. S. Newhall.

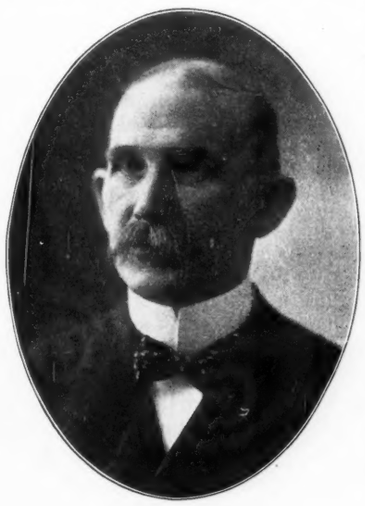
OBITUARY.

George W. Fletcher, District Freight Agent of the Southern Pacific at San Francisco, Cal., died on December 18.

F. H. Janvier, until six months ago Assistant General Solicitor of the Lehigh Valley, died on December 24 at his home in South Orange, N. J.

Theodore Meyer, Assistant to the Vice-President and General Manager of the Tehuantepec National, died at his home in Mexico City on November 8. He was for many years connected with various industrial enterprises in Mexico.

George W. West, Superintendent of Motive Power of the New York, Ontario & Western, died December 24 at his home in Middletown, N. Y. He was born in 1847 at Troy, N. Y. After a public school education he began railway work in 1865 as machinist on the New York Central & Hudson River at Schenectady, and two years later was made a gang foreman, and by 1873 had become Master Mechanic of the Chenango Valley, now part of the New York Central & Hudson River. A year later he was made Master Mechanic of the Buffalo division of the West Shore. In 1886 he became Master Mechanic of the Mahoning division of the New York, Lake Erie & Western, now the Erie, and a year later was transferred, as Master Mechanic, to the Middle division. In 1888 he was made Master Mechanic of the Eastern division, with office at Jersey City. In 1890 he was appointed Superintendent of Motive Power of the New York, Ontario & Western, the position he held up to his death. Mr. West was prominent and active in the affairs of railway mechanical organizations, and to such an extent that he was well and favorably known in all parts of the country. He was President of the American Railway Master Mechanics' Association in 1894 and contributed much to the advancement and usefulness of the organization. In 1889 he became a member of the New York Railroad Club, was elected an executive member in 1892, and president of the club in 1894 and 1895. For the last seven years he had been chairman of the executive committee. He was re-elected for an eighth term on December 18. During this time he was also a member of the Central Railway Club, of which he was president in 1901 and 1903, and for several years was also a member of the executive committee. All who came in touch with Mr. West knew him as a man to be relied on to the fullest extent. No one ever heard him speak ill of another, as he had the broadest charity for his fellow men.



G. W. West.

Railroad Construction.

New Incorporations, Surveys, Etc.

ALBERTA, MOBILE & PENSACOLA.—Incorporated in Alabama, with $50,000 capital stock, to build from Alberta, Ala., south to Pensacola, Fla. The incorporators include H. C. Bartling, W. J. Lavoery and C. M. Staigen.

ALLEGHENY & NORTHWESTERN.—A charter has been granted this company in Pennsylvania, with $70,000 capital, to build a line from Mars, Pa., to Evans City, in Butler county, seven miles. John G. McPherson is President. David Dillinger, W. E. Heller, J. L. Killip and C. S. Javos, all of Philadelphia, are interested.

ATCHISON, TOPEKA & SANTA FE.—An officer writes that this company will do a reasonable amount of ballast work on the extension between Point Richmond, Cal., and Bakersfield during the present year.

CANADIAN NORTHERN ONTARIO.—Application will be made at the next session of the Canadian Parliament for authority to build lines of railway from Nipigon bay to the National Transcontinental Railway, with branch lines to the northern and southern ends of Lake Nipigon; from Vermilion bay to the point where the National Transcontinental Railway crosses the Abitibi river, and thence to the south end of Lake Temiskaming. Application will also be made for an extension of time for the commencement and completion of several of the company's authorized lines in Ontario as follows: from

Washago to Kincardine; Arnprior to Gananoque; Pembroke to Cobourg; Pickering to Owen Sound; Niagara to Goderich; Port Dover to Owen Sound; Hawkesbury to Toronto; Parry Sound to North Bay; French River to Batchewana, and Toronto to Ottawa.

Canadian Pacific.—Application will be made at the next session of the Canadian Parliament for an extension of the time for building the Ontario, Northern & Western, from Wright, Que., north to Maniwaki, and thence to James Bay; also from a point on the company's main line to Lake Temiskaming and also such branch lines as may be necessary, provided that they do not exceed 30 miles in length, excepting for the purpose of connecting with other railways.

Application will be made at the next session of the Canadian Parliament for an act extending the time for building the Tilsonburg, Lake Erie & Pacific from Ingersoll, Ont., passing through the counties of Oxford, Perth, Waterloo, Wellington, Dufferin, Grey and Simcoe, or any of them, to Collingwood, Ont.

Delaware & Eastern.—An officer writes that no work was done during the past year on the proposed extension to be built under the name of the Schenectady & Margaretville, from Margaretville, N. Y., northeast to Schenectady, 81 miles. (Oct. 2, p. 1075.)

Denver, Northwestern & Pacific.—Press reports from Denver, Colo., indicate that track laying on the line from Yampa to Steamboat Springs, about 27 miles, has been finished, and that this section will be put into operation in the early part of January; also that track laying on the division between Steamboat Springs and the Utah state line, about 145 miles, will be begun as soon as weather conditions permit. (Oct. 16, p. 1176.)

Grand Trunk Pacific.—According to a report from Toronto, Can., a statement showing progress of present condition on the western portion of this line has been issued, according to which steel has been laid for 865 miles, 1,132 miles being under construction, and 609 miles of the main line under survey, as are 130 miles of branch lines. This portion under survey lies chiefly in the mountain section between Wolf Creek and Prince Rupert. Progress on the remaining portion of the prairie section will be considerably hastened by the completion of the big Battle river bridge, which is a steel viaduct 770 ft. long and 184 ft. high, consisting of 54 spans. Work and track laying on the section between Battle river and Edmonton is now proceeding rapidly and it is expected that the line will be completed from Edmundton to Winnipeg in the early part of January.

Holston River Railway.—See Virginia & Southwestern.

Ilwaco Railroad.—See Union Pacific.

Indianapolis, Cloverdale & Terre Haute Traction.—This company has announced that bids will soon be asked for building the first division of the line from Mooresville, Ind., northwest to Roachdale, about 26 miles. E. M. Bauman, Indianapolis, Ind., may be addressed. (June 19, p. 209.)

Kansas, Southern & Gulf.—The following have been elected officers of this company, which was recently sold to Chicago capitalists: President, P. E. Stanley, Chicago; Vice-President, John A. Fletcher, Chicago; General Manager, William C. Ross, Westmoreland, Kan.; Chief Engineer, E. C. Simmons, Westmoreland, Kan. It is officially announced that the reorganized company expects to construct at once an extension of 22 miles from Westmoreland, Kan., to Manhattan, and bonds to the amount of $22,000 were voted by the people of Pottawatomie township, in which Manhattan is located, on December 15. Nearly all the right-of-way has been secured and surveys made. The residents along the route have subscribed for a large part of the first mortgage 5 per cent. bonds issued for construction, and such subscriptions from present indications will be over $200,000. (Dec. 4, p. 1500.)

Kootenay Central.—Application will be made at the next session of the Canadian Parliament for an act extending the time for the completion of the authorized lines from Fort Steele, B. C., to the international boundary, via Elko, and from Fort Steele to Golden, via Windermere.

Marshall & East Texas.—According to reports from Marshall, Tex., residents of that place have been asked by the M. & E. T. to give the railway company a site for its terminal grounds and stations, in the southern portion of the city; also right of way from Marshall to the Panola county line, and right of way south from that point in Panola county; also to grant the company a bonus. As soon as the negotiations are completed work is to be started on the proposed extension south from Marshall. (Dec. 11, p. 1560.)

Minidoka & Southwestern.—See Oregon Short Line.

Northwestern Railroad.—See Union Pacific.

Ohio Roads (Electric).—Surveys are said to be under way on the last link between Grove City, Ohio, and Columbus, for a new interurban line projected from Cincinnati, Ohio, northwest to Columbus, about 125 miles. From Cincinnati north the line is finished to Lebanon, from which place the route passes east through Wilmington to Washington Court House, thence over a private right of way north to Mt. Sterling, thence via Harrisburg and Grove City to Columbus. B. F. Kroger, of Cincinnati, is said to be the principal promoter.

Oregon Railroad & Navigation.—See Union Pacific.

Oregon Short Line.—An officer writes that surveys are now under way for a line of about 120 miles from Twin Falls, Idaho, south to a connection with the Southern Pacific, about 20 miles east of Wells, Nev. Articles of incorporation of the Minidoka & Southwestern have been amended and extended to cover this survey. The survey passes through Hollister. Construction has not yet been authorized. The line, if built, will serve as the western and southern outlet for the agricultural country around Twin Falls, giving that section access to the mining camps of Nevada, as well as a shorter line to the Pacific coast.

Surveys were made some time ago for a line from Rupert, Idaho, northwest to Fuller, but construction has not yet been authorized. The line passes through what is expected to become a very productive section when placed under irrigation.

St. Mary's & Western Ontario.—The Canadian Government has entered into a supplemental agreement regarding the subsidy contract for building a line between Woodstock, Ont., and Exeter, 45 miles. The original contract provided for a subsidy at the rate of $3,200 a mile. The act, in which aid for the building of railways is voted, provides that subsidies may be granted at that rate, where the cost of construction does not exceed $15,000 a mile, and may be increased to $6,400 a mile as cost of construction increases. (Dec. 25, p. 1664.)

Schenectady & Margaretville.—See Delaware & Eastern.

South Omaha & Western.—See Union Pacific.

Texas Roads.—Surveys are being made for a line from Pecos, Tex., southwest to Ballmorhea, about 35 miles, and it is probable that the line will be built at once. It is understood that residents of Pecos and Ballmorhea, associated with M. L. Swernhart, of Chicago, are back of the project.

Texas Roads (Electric).—The construction of a number of interurban electric lines in Texas will be started within the next few months, it is said. Projects are on foot for building several electric lines between Dallas and towns within a radius of 75 miles.

A line is to be built from Fort Worth west to Mineral Wells, about 50 miles. John Scullin, of St. Louis, Mo., and associates are interested.

It is expected that an interurban electric line from Houston, Tex., southeast to Galveston, 50 miles, will be built within the next 18 months. The Stone & Webster interests are understood to be back of this project. The preliminary plans for this line were made some time ago but actual construction has been delayed by the several steam railways which enter Galveston in agreeing to the plans for the proposed causeway across Galveston bay. The construction work on the causeway is to be started soon.

Surveys made for an electric line from Beaumont, Tex., southeast to Port Arthur, about 20 miles. John W. Gates, of New York and Port Arthur, Tex., is said to be back of the project.

Colonel S. W. Fordyce, of St. Louis, Mo., and associates, who own the Rio Grande Railway, which runs from Brownsville, Tex., northeast to Point Isabel, 22 miles; will soon begin the work of electrifying the line for electric traction.

Lon Hill, of Harlingen, Tex., is promoting the building of an electric line from Harlingen, Tex., south to Brownsville. New towns have sprung up along the route and land is being

rapidly divided into small farms and placed under cultivation.

The proposition to build an interurban electric line from San Antonio, Tex., north to New Braunfels, 30 miles, is said to be under consideration by the Stone & Webster interests.

UNION PACIFIC.—The report of this company for the year ended June 30, 1908, shows that the construction of the double-track railway of the South Omaha & Western, from South Omaha, Neb., to Lane, 11.60 miles, was completed during the year. This line shortens the distance between South Omaha and points west of Lane by 8.94 miles. Construction work temporarily suspended during the business depression is progressing on the lines of the following companies or of companies organized in their interest as follows:

Union Pacific.—On the remaining 52.63 miles of the projected line from Hershey, Neb., to Northport, 51.17 miles were graded and ready for track. Grading on the extension of the Topeka & Northwestern branch, from Onaga, Kan., to Marysville, was completed on 13.13 miles, and is in progress on the remaining 19.18 miles.

Northwestern Railroad.—On this line from Blake's Spur, Ore., to Homestead, 58 miles, grading was completed on 28 miles and partly completed on five additional miles.

Oregon Railroad & Navigation.—The line of this company between Lewiston Junction, Wash., and Lewiston, Idaho, 72.30 miles, was completed and open for traffic on July 7, 1908.

Ilwaco Railroad.—An extension from Holmans, Wash., to Meglers, 13.39 miles, was completed and open for traffic on June 1, 1908.

VIRGINIA & SOUTHWESTERN.—Announcement is made that this company will resume work, which was suspended early in 1907, on the Holston River Railway, and which had part of the 38 miles finished at the time of the suspension of work. It is expected to have the line finished and in operation in six months from Persia, in Hawkins county, Tenn., northeast into the coal fields of southwest Virginia. Connection is to be made with the Virginia & Southwestern at Moccasin gap, Va. (R. R. G., May 15, p. 688.)

WISCONSIN CENTRAL.—An officer writes that the extension of this road from Ladysmith, Wis., north to Superior, 108.5 miles, is to be opened for operation January 4.

Railroad Financial News.

BOSTON & MAINE.—Debenture 4½ per cent. 20-year bonds, amounting to $11,700,000, have been sold to William A. Read & Co., New York. It is said that the bonds were sold at about 103.

CHICAGO & NORTH WESTERN.—Directors, it is said, are to vote early in January to issue $10,000,000 new bonds to fund outstanding obligations, amounting to about $8,000,000, maturing in 1909.

CHICAGO TERMINAL TRANSFER.—The minority stockholders' protective committee, George I. Malcom, chairman, representing about 80,000 shares of preferred stock, has sold between 65,000 and 70,000 shares of the preferred stock to a purchaser, understood to be the Baltimore & Ohio. This sale is in accord with the offer made some time ago. (Dec. 4, p. 1501.)

INDIANAPOLIS TRACTION & TERMINAL.—An initial dividend of 1 per cent. has been declared on the $5,000,000 stock. The dividend is payable December 31. The company operates the 136 miles of trolley line of the Indianapolis Street Railway and has completed 11 miles of double-track interurban line.

KANSAS, SOUTHERN & GULF.—This road recently was sold to Chicago parties, including P. E. Stanley and John A. Fletcher. See Railroad Construction.

LITTLE ROCK RAILWAY & ELECTRIC.—A semi-annual dividend of 2½ per cent. has been declared on the $1,500,000 common stock. This increases the annual rate from 4 per cent., paid since June, 1906, to 5 per cent. The company operates about 32 miles of street railway in Little Rock, Ark.

NEW YORK, NEW HAVEN & HARTFORD.—Control of the Tarrytown, White Plains & Mamaroneck is said to have been acquired by the New Haven company. The Tarrytown, White Plains & Mamaroneck, which is in the hands of a receiver, operates a road extending from Tarrytown station, on the New York Central & Hudson River, to Mamaroneck on the sound, and from White Plains station, on the Harlem branch of the New York Central & Hudson River, to Silver Lake Park, a total of a little over 23 miles.

NORFOLK & SOUTHERN.—The receivers have been authorized to issue $1,000,000 one-year 6 per cent. certificates, the proceeds to be used for repairs and maintenance. The certificates are not to be sold for less than 98, and no other issue of certificates to a greater amount than $500,000 is to be placed on a parity with this issue.

NORTHERN SECURITIES CO.—A dividend of 4 per cent. has been declared on the $3,954,000 stock payable January 11. This compares with 5 per cent. paid from January, 1906, to January, 1908, inclusive.

RUTLAND.—No dividend was declared on the preferred stock by the directors at their meeting held on December 23. This stock is a 7 per cent. cumulative preferred, but 4 per cent. annually is the most that has ever been paid on it; since 1906 only 1½ per cent. a year has been paid.

TARRYTOWN, WHITE PLAINS & MAMARONECK.—See New York, New Haven & Hartford.

UNDERGROUND ELECTRIC OF LONDON.—William Barclay Parsons and Colonel Millard Hunsiker have been elected directors.

WESTERN MARYLAND.—The receiver has been authorized to sell $536,000 5 per cent. receivers' equipment certificates, to be dated January 1, 1909.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Wabash-Pittsburgh Terminal Co., reported in the *Railroad Age Gazette* of November 27 and December 25 as being in the market for 12 consolidation locomotives, has ordered these locomotives from the American Locomotive Co.

The Mississippi Central, as reported in the *Railroad Age Gazette* of December 25, has ordered two passenger locomotives from the American Locomotive Co. These will have cylinders 19 in. x 26 in., 69-in. driving wheels, and will be equipped with Otis steel firebox crown sheets, Chicago lubricators and Ohio injectors.

The Harriman Lines, as reported in the *Railroad Age Gazette* of December 11, have ordered two Mallet (2-8-8-2) compound locomotives from the Baldwin Locomotive Works.

General Dimensions.

Weight on drivers	390,000 lbs.
Total weight, engine	430,000 "
Cylinders	26 in. and 40 in. x 30 in.
Diameter of drivers	57 in.
Boiler, type	Straight top
Boiler, working steam pressure	200 lbs.
Heating surface, water-heater tubes	1,046 sq. ft.
" " boiler tubes	4,927 "
" " firebox	199 "
" " total	6,172 "
Tubes, number, water-heater, about	400
" number, boiler, about	400
" outside diameter	2¼ in.
" length, water-heater	5 ft. 3 in.
" length, boiler	21 ft.
" material	Shelby steel; Nat. Tube Co.
Firebox, type	Oil burning
" length	126 in.
" width	78¼ in.
" material and maker	Otis steel
Grate area	68 sq. ft.
Water capacity	9,000 gals
Oil capacity	2,850 gals.
Tractive effort	94,640 lbs.

Special Equipment.

Bell ringer	U. S. Metallic
Brakes	Westinghouse
Brakes, foundation rigging	American Brake Co.
Brake-beams	Damascus
Brake-shoes	Am. Brake Shoe & Fdry Co.
Couplers	National Malleable Castings Co.
Headlight	Acetylene Handlan-Buck
Injector	Nathan
Journal bearings	Hewitt
Sanding devices	Am. Locomotive Sander Co.
Sight-feed lubricators	Nathan
Superheater	Baldwin
Valve gear	Walschaerts

CAR BUILDING.

The Escanaba & Lake Superior is in the market for 50 forty-ton flat cars.

The New Mexico Central expects soon to be in the market for a number of mail and passenger cars.

The Toledo, Ann Arbor & Detroit has ordered one all-steel gasolene motor car from the McKeen Motor Car Co.

The Birmingham Southern, reported in the *Railroad Age Gazette* of December 4 as having ordered 175 fifty-ton all-steel hopper bottom coal cars from the Pressed Steel Car Co., has ordered but 160. These cars will weigh 43,000 lbs. and will be 32 ft. 7 in. long and 9 ft. 6 in. wide and 8 ft. 4 in. high, inside measurements, and 35 ft. 1 in. long and 10 ft. 1⅜ in. wide and 10 ft. 8 in. high over all. The bodies and underframes will be of steel. The special equipment includes:

Bolsters, body	Pressed steel diaphragms
Truck	Arch bar
Brakes	Westinghouse
Brake-beams	Pressed steel
Couplers	Climax
Draft gear	Westinghouse
Dust guards	Wood
Journal boxes	Kensington
Wheels	Schoen

The Virginian Railway was reported in the *Railroad Age Gazette* of December 18 as having ordered 1,500 fifty-ton all-steel gondola cars from the Pressed Steel Car Co. These cars will weigh 43,800 lbs. and will be 40 ft. long, 9 ft. 4 in. wide and 4 ft. 6 in. high, inside measurements. Cars of this same design were illustrated and described in the *Railroad Age Gazette* June 12, 1908. The special equipment includes:

Axles	Open-hearth steel
Bolsters, body truck	Pressed steel
Brakes	Westinghouse
Brake-beams	I-beams, 14.75 lbs.
Brake-shoes	Streetor
Brasses	Lead lined
Draft gear	Westinghouse friction, Farlow attachments
Dust guards	Wood
Journal boxes	Malleable iron
Side bearings	Malleable iron, chilled cast-iron
Trucks	Arch bar
Wheels	Cast iron, 725 lbs.
Center plate, top	Cast steel
Center plate, bottom	Drop forged

The Virginian Railway, as reported in the *Railroad Age Gazette* of December 25, has ordered eight coaches, four parlor cafe cars, four mail and baggage and two baggage cars from the Barney & Smith Car Co., for delivery within 90 days. These cars will be 61 ft. long over end sills. The special equipment includes:

Brakes	Westinghouse quick action
Couplers	Tower
Curtain material	Pantasote
Draft gear	Westinghouse
Dust guards	Wood
Heating system	Direct steam
Journal boxes	Malleable iron
Lighting system	Oil lamps
Paint	Virginian Ry. standard
Seats	Pressed steel underframes
Seat covering	Pantasote
Side bearings	Malleable iron, Wood's rollers
Trucks	4-wheel
Vestibules	Wide, with steel trap doors
Vestibule diaphragms	Canvas
Wheels	Rolled steel
Window fixtures	National

IRON AND STEEL.

The Canadian Pacific is said to have given a contract to the Algoma Steel Co. for 20,000 tons of rails.

The Pittsburgh & Lake Erie will soon place a contract for 10,000 tons of rails for delivery early in 1909.

The Philadelphia & Reading has placed an additional order for 15,000 tons of rails with the Pennsylvania Steel Co.

Rail Production in 1908.

Railway construction during 1908 is estimated to have been but little under 3,215 miles, calling for between 500,000 and 600,000 tons of steel rails, a very small tonnage. Renewals alone under normal conditions call for about 1,000,000 tons. This year replacements have been kept down to the minimum. The year began with many suspended rail orders, the held over contracts aggregating about 700,000 tons. New contracts have been very meagre throughout the year, so that probably the entire rolling of all mills has not been over 1,500,000 tons; but recently orders for about 250,000 tons have been placed for 1909 delivery, and probably as much more is under negotiation, and it is hoped that some of these contracts will be placed this week.—*Journal of Commerce.*

RAILROAD STRUCTURES.

Erwin, Tenn.—The Carolina, Clinchfield & Ohio has given contract to J. P. Pettyjohn & Co., Lynchburg, Va., for the shops to be built here.

Hammond, Ind.—The Chicago, Indianapolis & Louisville has contracted for a bridge over the Grand Calumet river at Hammond. The bridge is to have one 108-ft. single leaf bascule span, Page type, with a 40-ft. girder approach, and one 108-ft. through truss span, so designed that it can be converted into a bascule span when required. The bridge is to be wider than the ordinary single-track bridge, as it is intended to lay a gauntlet track over the structure. Both spans rest upon a pier in the center of the river. The piers are built of concrete. The American Bridge Co. has the contract for the superstructure, the Ferro Construction Co. for the erection, and the Great Lake Dredge & Dock Co. for the substructure. W. H. Hughes, Chicago, is the Designing Engineer and Robert W. Hunt & Co., Chicago, are the Consulting Engineers.

Hillyard, Wash.—The Great Northern has plans ready for enlarging its shops at Hillyard, at a cost of about $200,000. The machine shop is to be changed from a seven-pit to a 20-pit shop, giving increased facilities for repairing locomotives. The floor space of the coach shop is to be doubled and several stalls will be added to the roundhouse.

Huntington, Tex.—The Texas & New Orleans has bought a ten-acre tract of land as a site for a roundhouse, machine shop and additional track facilities. Work will be commenced soon.

Marshall, Tex.—See Marshall & East Texas under Railroad Construction.

Renovo, Pa.—The division officers of the Pennsylvania Railroad have made an estimate of cost of building a boiler shop at this place, but this work has not yet been authorized.

St. Paul, Minn.—The St. Paul Bridge & Terminal Railway, as reported in our issue of December 4, has given the contract for the superstructure of a bridge across the Mississippi river, including 950 tons of steel, to the American Bridge Co. The approaches and the substructure will be built by W. J. Hoy, of St. Paul. The bridge will consist of a 450-ft. draw span, having a clear opening of 180 ft. on each side of the central pier with a 190-ft. fixed span and a short girder span on each side. The approaches will be pile and lumber trestles. The piers will be concrete construction on a pile foundation. The work will necessitate the use of 950 tons of steel and the construction of 1,500 cu. yds. of concrete and 12,000 lineal ft. of piling. The plans for the main structure were made by L. P. Wolff, Consulting Engineer, St. Paul, and construction will be supervised by Alfred Jackson, Chief Engineer of the Terminal Railway.

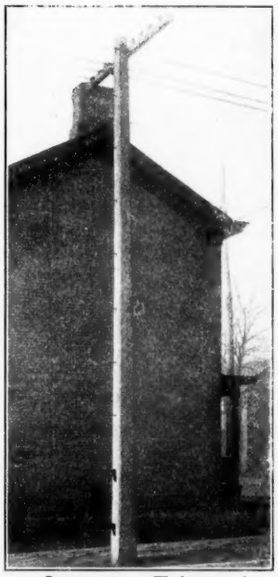
Seattle, Wash.—Press reports indicate that the Union Pacific has given a contract to Chase Bros. for building the Georgetown viaduct. The cost of this structure is said to be about $20,000.

Tacoma, Wash.—Local reports indicate that a contract has just been given to Hudson & Rydstrom, of Tacoma, for building the Union Pacific tunnel in Tacoma. The bid is said to have been $800,000.

It is reported in Tacoma that Cornell Bros., of that city, have been awarded contract for the local warehouse of the Great Northern. (Dec. 18, p. 1612.)

Wenachtee, Wash.—Local reports indicate that the Great Northern will enlarge its yards.

Concrete Telegraph Poles on the Pennsylvania.



Concrete Telegraph Pole.

The Pennsylvania Lines West have just completed and placed in experimental service a number of concrete telegraph poles through New Brighton, Pa. This construction followed a series of experiments which have been carried on during the past two years. In 1906 concrete poles, as a substitute for wood, were first tested. Fifty-three reinforced concrete poles were placed in line on the Pittsburgh, Fort Wayne & Chicago near Naples, Ind. One year later these were giving entire satisfaction and showed no evidences of disintegration. Much importance is also attached to the increased strength of these poles, which are said to hold the strain of the line, even on curves, without any bracing. The poles at New Brighton are about 30 ft. long, 14 in. in diameter at the base and 6 in. at the top. The accompanying illustration shows the general appearance of one of these concrete telegraph poles.

SIGNALING.

The Chicago, Rock Island & Gulf has recently completed and turned over to the Missouri, Kansas & Texas for operation a 28-lever interlocking plant at Carrollton, Tex. This is a mechanical plant, Saxby & Farmer machine with 23 working levers. It is at the crossing of the C., R. I. & G., the M., K. & T., and the St. Louis South Western.

The St. Louis & San Francisco signaling, to be put in by the Union Switch & Signal Company, includes 700 miles of single track and 25 miles of double track. The sections to be covered are the Eastern division from St. Louis to Monett, Mo.; the Northern division from Kansas City, Mo., to Springfield, Mo.; the Ozark division from Springfield, Mo., to Thayer, Mo., and the Southeastern division from Amory, Miss., to Birmingham, Ala. The signals are to be located so as to make the blocks approximately two miles long. It will require 1,200 signals. On the double track the "wireless" system is to be used. The signals are to be of electric motor, three position normal clear, and are to give the indications in the upper right-hand quadrant. The night indications are to be red for stop; yellow for distant, and green for proceed. The lamps are to have long-time burners. Gravity battery is to be used for track circuits and a caustic soda primary battery will provide the motive power for the signals. The Signal Company expects to have the signals in operation by January 1, 1910.

The Stiegelmeyer Automatic Train Stop.

This device, made by the Stiegelmeyer Automatic Train Control Company, 1028 Nelson street, Indianapolis, was tested on the Cleveland, Cincinnati, Chicago & St. Louis near Beech Grove, 12 miles southeast of Indianapolis, on December 16. About 100 railway men were present. The tests were made with a locomotive and five coaches. Two were made at a speed of 40 miles an hour and one at 12 miles an hour. In each of the tests at the higher rate of speed the train was brought to a stop within a little less than 800 ft., while at the lower rate the stop was effected within 100 ft. In this device a revolving disk is attached beneath the engine and connected with the air line. The disk comes in contact with a third T rail 30 ft. long on the outside of the track. The T rail is put in position by the signalman so that it will impinge on the revolving disk and thereby open an air valve on the train and set the brakes; also it shuts off the steam. H. F. Houghton, a member of the American Railway Association Committee on Safety Appliances, was present, as was also Alexander Shane, chief inspector for the Indiana State Railroad Commission.

Supply Trade News.

The Westinghouse Air Brake Co., Pittsburgh, Pa., expects to resume work on full time at its Wilmerding plant at the beginning of the year.

The General Railway Supply Co., Chicago, will move its offices on January 1, from the ninth floor of the Marquette building to room 531 of the same building, where larger quarters have been secured.

The Commercial Dump Car Co., Chicago, has been incorporated with $100,000 capital by George W. Holmes, S. L. Page, Jesse B. Hawkins, Backburn Esterline and Edward W. Everett, all of Chicago.

J. S. Coffin, who has been for a number of years in the mechanical department of the Galena Signal Oil Co., Franklin, Pa., has been elected Vice-President of the American Brake Shoe & Foundry Co., Mahwah, N. J., effective January 1, with office at New York.

W. White, President of the National Boiler Washing Co., Chicago, who sailed on November 25 for England and the continent in connection with business relating to boiler washing systems, returned to Chicago on December 27. He reports a pleasant and successful trip.

The Parkesburg Iron Company, Parkesburg, Pa., have placed a contract for the immediate erection of a steel building 85 ft. x 150 ft. as an addition to its tube mill. This new building will be at the finishing end of the mill, and will be served throughout by a traveling crane.

The Acme White Lead & Color Works, Detroit, Mich., has increased its capital stock from $1,250,000 to $2,000,000. This was made necessary by the steady growth of the company and to provide capital for the further development of the new white lead corroding department.

The Whiting Foundry Equipment Co., Harvey, Ill., has supplied the wheel pits, pitting trolleys, electric puller machines, transfer car for core oven, floor cranes, reservoir ladles and teapot spout wheel pouring ladles for the new St. Louis, Mo., plant of the American Car & Foundry Co.

Frank C. Osborn, President of the Osborn Engineering Co., Consulting Engineers, Cleveland, Ohio, was recently appointed one of the Commissioners of the Cuyahoga County Court House Commission, which has charge of building the new county court house and other county buildings.

The Ritter Folding Door Co., Cincinnati, Ohio, has been awarded the contract for equipping the shops of the Carolina, Clinchfield & Ohio at Erwin, Tenn., with Ritter folding doors, constructed of wood and glass. The contractors for these shops are John P. Pettyjohn & Co., Lynchburg, Va.

The American Blower Co., Detroit, Mich., gave each of its employees this Christmas one dollar and one additional dollar for each year of continuous employment. This was the same distribution that was made two years ago. Last year, owing to the business depression, nothing of this nature was done.

The Chicago, Indianapolis & Louisville has contracted with the American Bridge Co. for the erection of a new bridge across the Grand Calumet river, Hammond, Ind. Robert W. Hunt & Co., Chicago, are the Consulting Engineers for the railway. More complete details regarding this work may be found under Hammond, Ind., in Railroad Structures.

William B. Dickson, Second Vice-President of the United States Steel Corporation, has been elected First Vice-President, succeeding James Gayley, who resigned several weeks ago to look after his private business affairs. David G. Kerr, of Pittsburgh, Pa., who has been largely identified with the

raw material department of the Steel Corporation, succeeds Mr. Lickson.

The Whiting Foundry Equipment Co., Harvey, Ill., has appointed the United Steel & Equipment Co., Seattle, Wash., its representative for Vancouver, B. C., Portland, Ore., and the state of Washington. It has also appointed Gorman, Clancey & Grindley, Ltd., Calgary, Alb., its representatives for Alberta and the southeastern corner of British Columbia. These agencies will have charge in their respective territories of the sale of the electric traveling and other types of cranes, foundry equipment, cupola furnaces, air hoists and steel and malleable foundry equipment made by the Whiting company.

The fifth annual convention of the National Association of Cement Users will be held at Cleveland, Ohio, on January 11-16. Among the papers to be read that will be of interest to railway men are the following: "Cost of Reinforced Construction as Applied to Bridges," by E. H. Guimby, Engineer of Bridges, Philadelphia, Pa., and E. P. Goodrich, Consulting Engineer, New York City; "Advantages of Reinforced Concrete for Railroad Construction," by B. H. Davis, Assistant Engineer D., L. & W., Hoboken, N. J.; also a paper on "Cost of Concrete Telegraph Poles."

The American Automatic Stoker Co., which has recently been organized to manufacture a new type of automatic stoker, has arranged to open offices in Chicago and New York. John J. Hannahan, heretofore Grand Master of the Brotherhood of Locomotive Firemen and Engineers, has resigned, effective January 1, to become First Vice-President of the new company, in charge of the Chicago office. The building of a new plant is under consideration. D. W. Ross, T. P. Shonts and Edwin Hawley are interested.

Lincoln Bush, heretofore Chief Engineer of the Delaware, Lackawanna & Western, has resigned to engage in private practice, January 1, as Consulting Engineer, with office at 1 Madison avenue, New York. He expects to devote a part of his time to the development of the Bush train shed. This train shed is now in use in the Lackawanna's stations at Hoboken, N. J., and Scranton, Pa., and Mr. Bush has recently closed a contract for its use in the new Chicago & North Western passenger terminal at Chicago. He has also been made Consulting Engineer of the Bradley, Gafney, Steers Co., a new contracting firm composed of well-known New York contractors. The office of this company will also be at 1 Madison avenue. Mr. Bush was born in 1861 in Illinois. He graduated from the University of Illinois in 1888, having taken the civil engineering course. He received the degree of Doctor of Engineering from this university in 1904. He began railway service in 1888 as assistant engineer of maintenance of way on the Wyoming division of the Union Pacific. A year later he was made assistant engineer on location of the Pacific Short Line at Ogden, Utah. For a few months in 1890 he was an assistant instructor at the University of Illinois, and then went with E. L. Corthell as assistant engineer on bridge work at Chicago. At the end of 1891 he went to the Pittsburgh Bridge Company as chief draftsman at its Chicago office. Five years later he went to the bridge department of the Chicago Drainage Canal, but after a few months resumed railway work as assistant to the Bridge Engineer of the Chicago & North-Western at Chicago. Three years later he was made Acting Division Engineer of the same road at Boone, Iowa, and at the end of 1899 went to the Delaware, Lackawanna & Western as Bridge Engineer. He was made Principal Assistant Engineer of this road in 1900 and Chief Engineer in 1903.

Lincoln Bush.

TRADE PUBLICATIONS.

Air Compressors.—Catalogue No. 100, issued by the Thos. H. Dallett Co., Philadelphia, Pa., partially illustrates and describes the air compressing machinery which it manufactures. It has 24 pages, 6 in. x 9 in.

Side Crank Engine.—Bulletin No. 20, issued by the Ridgway Dynamo & Engine Co., Ridgway, Pa., illustrates and describes the Ridgway single-valve side-crank engine. A general description of this engine appeared in the *Railroad Age Gazette* of December 4.

Brill's Magazine.—The issue for December 15 of this periodical, published by the J. G. Brill Co., Philadelphia, Pa., contains a number of articles regarding cars recently built for various street and interurban railways. This issue also contains the index of Volume II.

Ruberoid.—The December issue of *The Exchange*, published by the Standard Paint Co., New York, shows, on its outside cover, a half-tone illustration of the Greek Temple on Young's Million Dollar Pier at Atlantic City, N. J., which building is covered with Ruberoid roofing.

Thermit.—The issue of *Reactions*, published by the Goldschmidt Thermit Co., New York, for the fourth quarter of 1908, contains an article entitled "Welding Mud Rings on Locomotives," also an article entitled "The Use of Thermit Steel," which deals with thermit as used in welding massive machinery.

Switch Point Lock.—A 36-page note book being distributed by the W. K. Kenly Co., Chicago, has two pages in the middle of the publication suggesting the use of the Latimer switch point lock for safety. The book is bound in brown suede and the paper is of good quality bond. This lock was described in the *Railroad Age Gazette* of December 25.

Metal Protective Paint.—A descriptive catalogue issued by the Arkon Carbon Co., First National Bank building, Chicago, sets forth the qualities to be found in Arkon carbon paint for the protection of metal. The publication is accompanied by a fac-simile letter from Robert W. Hunt & Co., who made a series of severe tests of this paint and found it suitable as a protective coating for metal.

Reinforced Concrete.—The December issue of Designing Methods of Reinforced Concrete Construction, published by the Corrugated Bar Co., St. Louis, formerly the Expanded Metal & Corrugated Bar Co., treats of the special problems met in the design of reservoirs, with some remarks on this type of structure, also contains a detailed design with discussion of the rectangular reservoir with vertical walls backed with earth. Bulletin No. 7, which will appear in March, will treat of conduits and sewers.

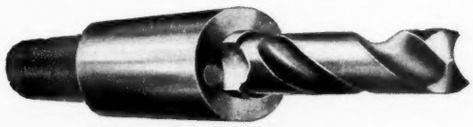
Stayin Drill Socket.

The accompanying cuts show two applications of the Stayin drill socket, made in various sizes by the G. R. Lang Co., Meadville, Pa. This drill socket holds drills with or without tangs, just as other sockets made for this purpose. The particular advantage claimed for it, however, is that the socket will stay in the drill press spindle. This is assured by making a groove in the shank of the socket to fit the round key in the drill press spindle. This groove is not shown in the accompanying cuts, but the key is applied to the spindle of the drill press just as the drill proper is keyed to the socket as shown herewith. To do this a drilling jig is used, which is loaned by the makers to their customers.

Lang Socket With New Drill.

On old drills, whose tangs have been broken, a flat is ground instead of a groove. The drift slot in the socket is made extra long,

so that the drill can be easily knocked out with the drift. Unbroken drills have a V groove milled in the shank, as shown. This takes a few minutes longer than grinding a flat, but it insures a good bearing the whole length of the key. The hardened steel keys are pressed in the sockets, truly parallel with the bore and central with the tang slot. The key projects into the interior of the socket only one-third

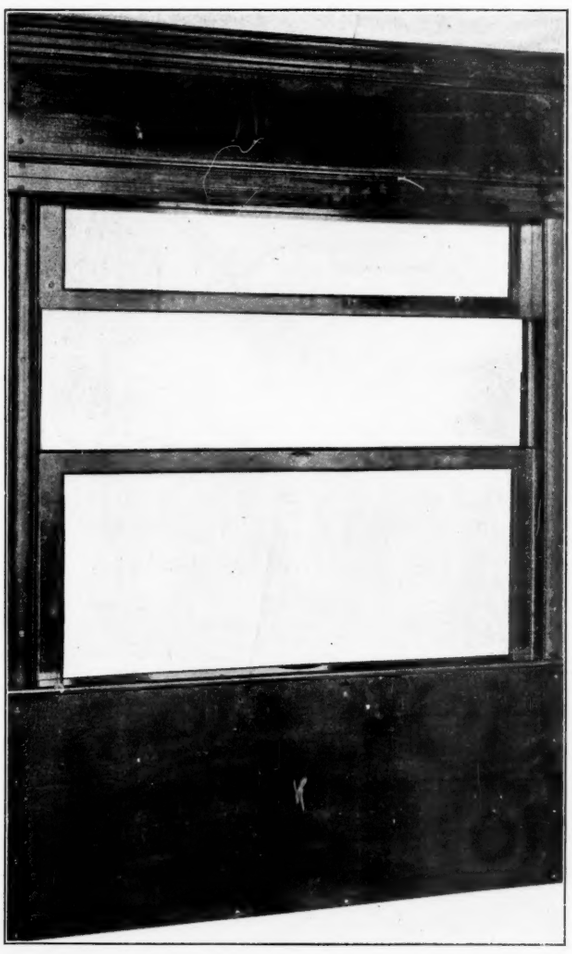


Lang Socket With Old Drill.

of its diameter. The walls of the sockets are made larger than standard sockets, so that they are not weakened by the insertion of the key; otherwise the sockets are standard, so that any combination can be made just as with ordinary drill sockets.

New Type of Window for Cars and Buildings.

The Board of Supervising Engineers, of the Chicago traction systems, is considering a new type of window, called the self-balancing, which is quite a novel and ingenious departure from present practice. The construction and operation of the device are illustrated by the accompanying drawing and photograph. Each sash is provided with a pair of vertical racks. The racks of the upper and lower sash on each side mesh with a pinion supported in the window frame. This pinion transmits the load and motion of one rack to the other so as



Strauss Car Window Partly Open; Inside View.

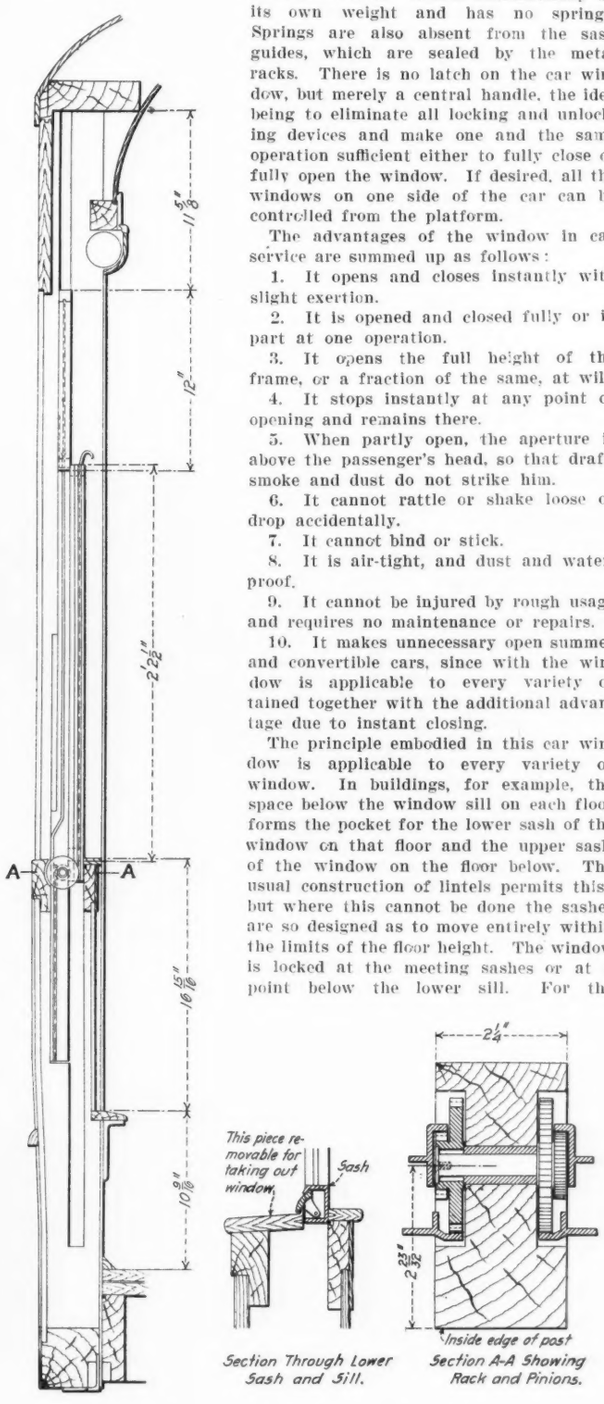
to counterbalance the sashes while moving them in opposite directions. Where sashes are of unequal size and weight, as in car windows, the pinions are differential and the smaller sash is provided with the necessary amount of counterweight, which is inserted in the frame. For double windows, as in Pullman cars, the two sashes are opposite each other in the closed position, as at present, and the opening and closing of the inner sash simultaneously opens and closes the outer one. The receding sashes disappear in enclosures or pockets above and below the window, so that when the window is fully open the whole area of the frame is available for ventilation.

To prevent rain and moisture from finding their way into the lower pocket when the window is closed, the lower sash is provided with a water-shedding device which is shown in detail in the drawings. This device consists of a metal piece which drops over a lip on the window frame when the sash is closed and is drawn down with it as it is lowered. It acts automatically by its own weight and has no springs. Springs are also absent from the sash guides, which are sealed by the metal racks. There is no latch on the car window, but merely a central handle, the idea being to eliminate all locking and unlocking devices and make one and the same operation sufficient either to fully close or fully open the window. If desired, all the windows on one side of the car can be controlled from the platform.

The advantages of the window in car service are summed up as follows:

1. It opens and closes instantly with slight exertion.
2. It is opened and closed fully or in part at one operation.
3. It opens the full height of the frame, or a fraction of the same, at will.
4. It stops instantly at any point of opening and remains there.
5. When partly open, the aperture is above the passenger's head, so that draft, smoke and dust do not strike him.
6. It cannot rattle or shake loose or drop accidentally.
7. It cannot bind or stick.
8. It is air-tight, and dust and waterproof.
9. It cannot be injured by rough usage and requires no maintenance or repairs.
10. It makes unnecessary open summer and convertible cars, since with the window is applicable to every variety of tained together with the additional advantage due to instant closing.

The principle embodied in this car window is applicable to every variety of window. In buildings, for example, the space below the window sill on each floor forms the pocket for the lower sash of the window on that floor and the upper sash of the window on the floor below. The usual construction of lintels permits this; but where this cannot be done the sashes are so designed as to move entirely within the limits of the floor height. The window is locked at the meeting sashes or at a point below the lower sill. For the



Window as Applied to Street Car.

latter method a small push button in one post is used. It prevents forcing either sash from the outside and permits the latching of the window closed, or partly or entirely open. In hotels, hospitals and public buildings, the windows may readily be adapted for mechanical or power operation, either individually or in series. Where electric power is available, a small motor driving the pinion can be con-

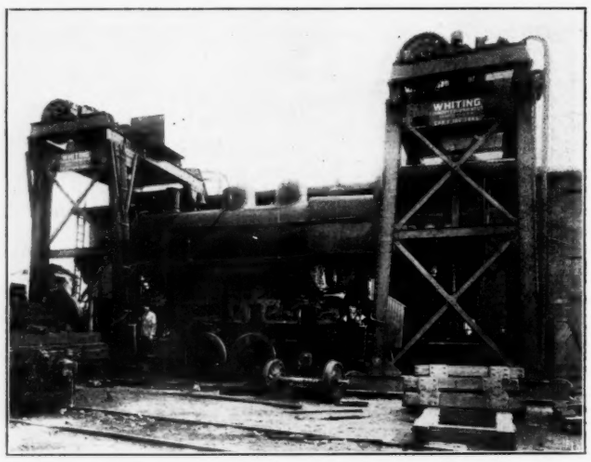
trolled from a switch, enabling an invalid, for instance, to open or close the window without leaving his bed. In buildings having automatic temperature regulators, the operation of the windows in each room can be controlled by these regulators if desired.

This window is also considered to be well adapted for storm sashes and screens. The pockets can be designed to house jointly the regular window sash, the storm sash and the screen, the last two remaining in the pockets out of season, and being brought into use only when needed. In this form the storm sashes could be provided with wire glasses and used for both fire and burglar protection.

The cost of windows of this type compares favorably with that of present types. Vertically moving doors and shutters for freight houses, roundhouses, warehouses, shops, etc., are also included in the application of this principle. The patents are owned and the devices are being put on the market by the Strauss Self-Balancing Window Co., Fort Dearborn building, Chicago.

Whiting Electric Gantry Cranes for the Great Northern.

The photograph reproduced herewith shows two electric gantry cranes furnished the Great Northern Ry. by the Whiting Foundry Equipment Co., Harvey, Ill. The crane is a one-motor type, the capacity being 100 tons. The power is both hand and electric. The span, center to center of runway rails, is 14 ft. 6 in.; clearance inside of legs, 13 ft.; height from top of rail to under side of girder, 20 ft.; distance between hook centers, 11 ft.; lift (travel of hook), 14 ft. 6 in. The bottom member of the frame has bearings to which are fitted double-flanged cast iron wheels. The load is lifted by means of steel wire rope winding on hoisting drums, all of the hoisting gearing being supported on the bridge girders by means of



Whiting Electric Gantry Cranes Handling a Locomotive.

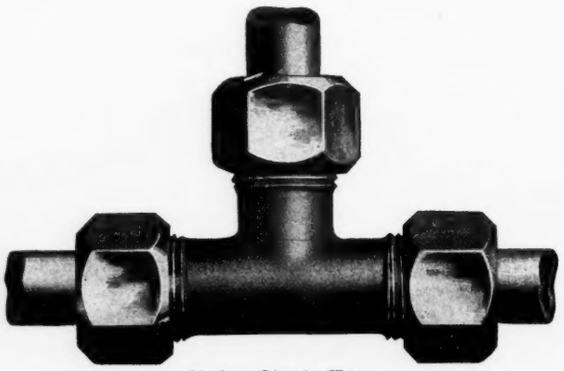
structural steel framing. The drums are designed to insure an equal distribution of the load upon the girders. The hoisting motor is comparatively small, as only slow speeds are required. The motor is fitted with the builders' automatic electric brake. This brake is operated by a solenoid in circuit with the motor so arranged that it acts automatically when the current is cut off from the motor. All parts are easily accessible for oiling and repairs. A factor of safety of five was used in designing the cranes. Six of them were sold to the Great Northern. As the photograph shows, they are especially adapted for lifting and unwheeling locomotives.

Union-Cinch Pipe Fittings.

The Union-Cinch pipe fittings illustrated herewith are designed for use wih small piping to enable neat, mechanical looking jobs to be made, and to prevent the difficulties encountered with the usual threaded pipe and tapped fittings. The joint is made by screwing down the outside nut, which presses a thin tapered shell into the annular cavity between the pipe and the fitting, as shown in the sectional view. The nut may be pulled up hard, causing the soft cone shell to make a perfectly tight joint around the tubing that will stand any pressure the tubing will stand.

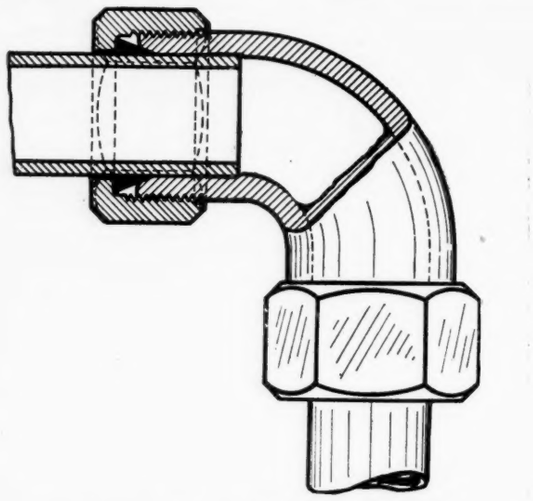
These fittings are made in sizes corresponding to standard iron pipe up to 1 in. Ordinary rough pipe may be used with them if the ends of the pipe are filed round and smooth; but the maker of the fittings is prepared to furnish smooth-drawn steel tubing corresponding to iron pipe sizes on the outside diameter. This tubing has a 16-gage wall in the ¾-in. and 1-in. size, and an 18-gage wall in smaller sizes, and has, therefore, a very much larger carrying capacity than ordinary pipe. This steel tubing is cheap, is thoroughly annealed and readily bent. A hack-saw and monkey wrench are all the tools that are needed, except where special work has to be done, in which case a bending rig of some sort is convenient. Each fitting is a union, and the piping may be taken down at any point where a fitting is inserted.

Where a nice looking job is desired, brass pipe may be used: although where nickel-plating is done, the steel tubing will nickel-



Union-Cinch Tee.

plate just as nicely as brass pipe and is much cheaper. These joints may be taken down and made up again any number of times without trouble. They are recommended by the maker, the Sight Feed Oil Pump Co., Milwaukee, Wis., for oil pump piping, gravity oiling devices, gages, drop pipes, etc., and particularly around ammonia



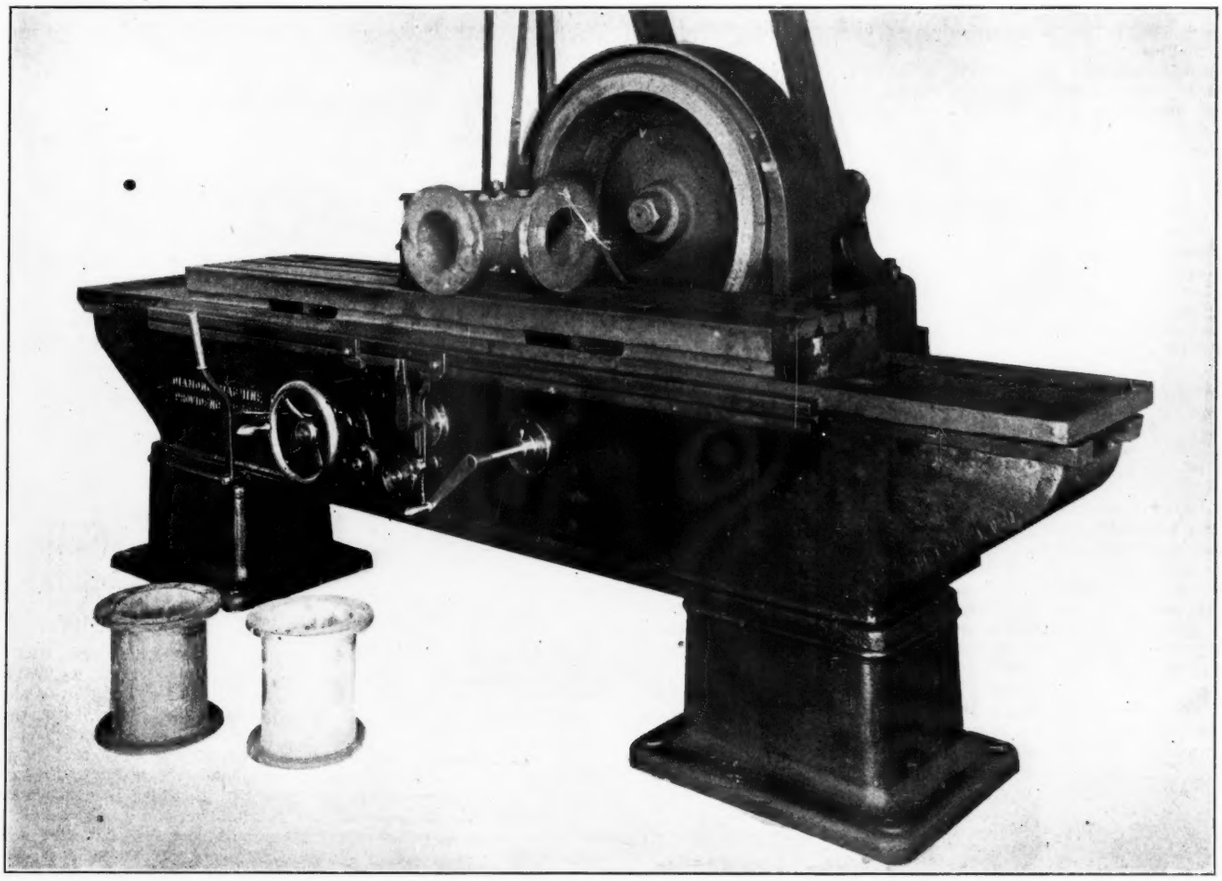
Sectional View of Union-Cinch Elbow.

handling machinery, the steel tubing and steel fittings being considered especially desirable because of the readiness with which they may be made tight against the escape of ammonia gas.

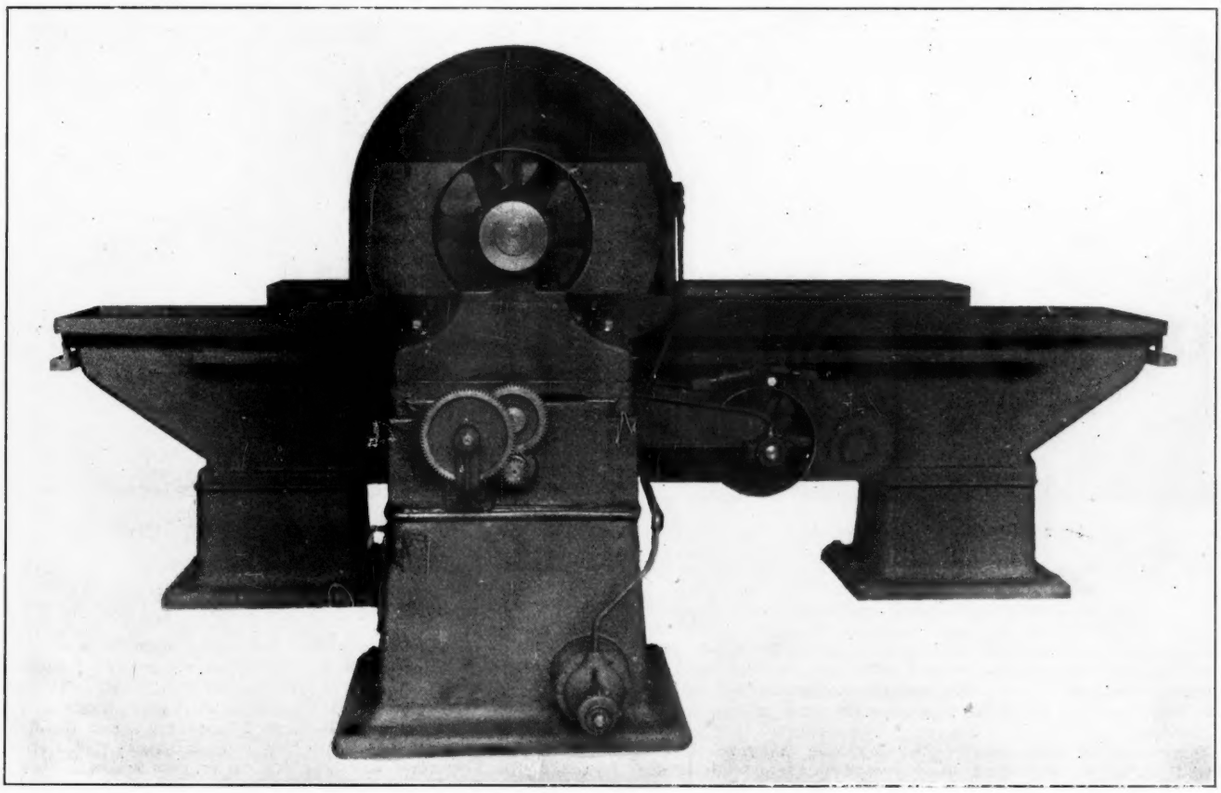
Guide Bar and General Face Grinder.

The Diamond Machine Co., Providence, R. I., has put on the market a large face grinder for general railway shop use. The machine is especially designed for grinding locomotive guide bars. It has also proved efficient in working on grinder columns, water meter cases, water pipe flanges, lathe legs and floor plates.

This machine has a number of advantages which give it special merit. Its operation is not hindered by hard iron or any other material. The work need not be as rigidly fastened as on a planer or milling machine. The movements of the mechanism are much the same as those of other machines doing this class of work. The wheel grinds cast iron with suitable speed. The emery ring is held in a steel-bound adjustable chuck, as machines of this nature require that the wheel should not run unsupported. The bearings are of ample size, made with babbitt, ring oiling, well protected from dust with the end thrust taken by a ball thrust-bearing. The longitudinal table feed is obtained by open and cross belts which are connected to a rack and heavy gearing. Automatic reversing mechanism is provided for any length of stroke and is shifted by adjustable dogs. When hand feed is desired, a clutch is thrown in mesh with the hand wheel shown in the illustration. The cross feed may be either hand



84-in. Diamond Guide Bar and Face Grinder.



Rear View; 84-in. Diamond Guide Bar and Face Grinder.

or automatic, and is capable of fine adjustment. All machines are supplied with automatic pumps with the necessary adjustments for wet grinding.

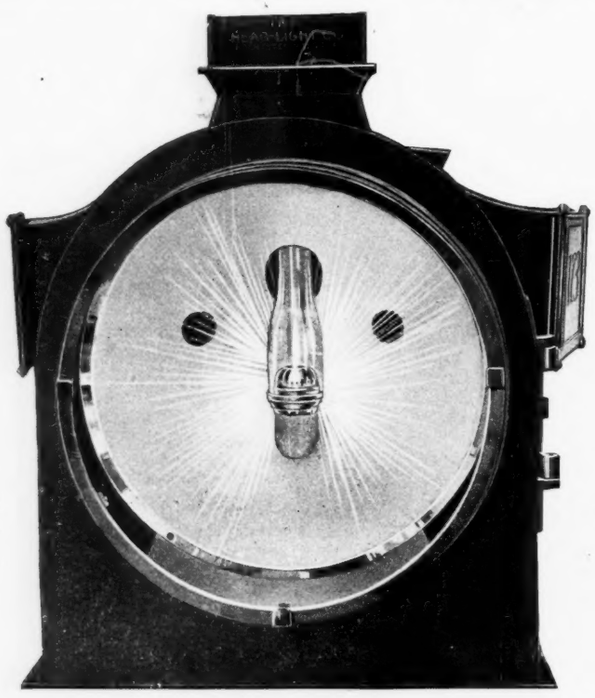
The machines have been built in 84-in. and 114-in. lengths for belt or motor drive. Longer machines can be made if desired. The following dimensions apply to the 84-in. machine, which is shown herewith:

Length of bed	134 in.
Length of table	130 "
Width of table	19½ "
Length of platen (four 13/16-in. slots)	84 "
Width of platen	17½ "
Table travel per min., in lin. ft.	20
Total length, including table travel	18 ft. 4 in.
Total floor space required	7 ft. x 18 ft. 4 in.
Wheel diameter	30 in.
Wheel revolution per min.	350 to 700
Wheel spindle	3½ in.
Wheel spindle bearing	3½ in. x 10 in.
Weight, complete with countershafts	about 8,000 lbs.
Weight, with motor drive	about 10,000 lbs.

Armorclad Headlight.

The Star Headlight Co., Rochester, N. Y., is putting out a new all-steel headlight, shown in the accompanying cut. The claims for it include perfect ventilation, absolute focus, strength and rigidity of the case, and, particularly, careful workmanship on the case and reflector. It is made in two sizes, 16 in. and 18 in., the smaller weighing net 70 lbs. and the larger 80 lbs. The case is of No. 20-22 gage, pickled, cold rolled and reannealed, open hearth steel. The base of the case is of No. 14 gage steel, with the sides bent at two angles; this does away with riveting on angle irons.

The oil vessel is a "one piece" oil pot, the bottom and back being made of a single piece, while the rest is double seamed throughout. This oil pot has only two holes in it, one at the filler cap and the other where the oil enters the burner. The oil pot support is of



Star Armorclad Headlight.

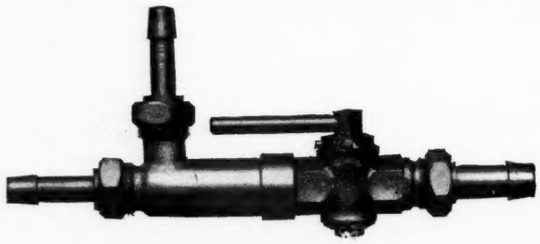
malleable iron. It is fastened with lock and wing nut and can be easily removed from the oil pot.

The burner is the Star Wilder patent stuffing box and brass oil pot connection. This is the same style as the regular Williams burner, with the exception of the Star patented arrangements. The reflector is made of aluminum or cold rolled and annealed lake copper, triple plated with silver. The box stand supporting the reflector can be raised or lowered so as to change the focus of the reflector if so desired.

A feature of the side number glass fastening is the device for holding the glass so that it can be removed from the outside. These glasses are 6½ x 10½ in. for either size of headlight. The goggle is held with the Wilder patent glass fastener. In this fastening no plaster of Paris is used, and the glass can be easily removed; also, allowance is made for expansion of the glass as it becomes heated.

Railway Vacuum Machine.

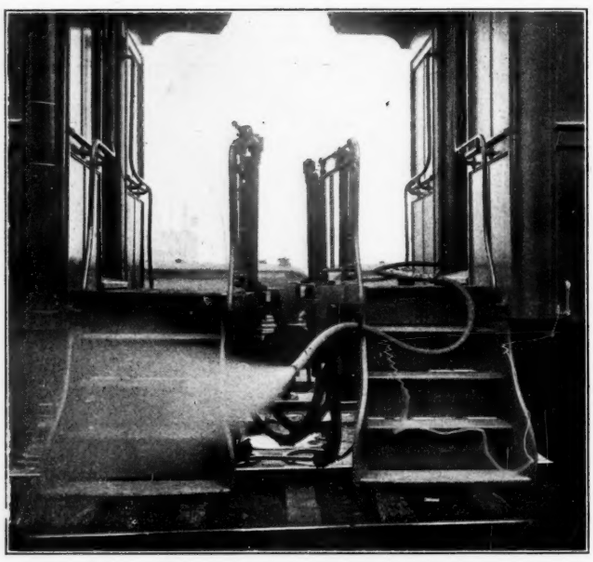
The accompanying illustration shows a device and method of its connection for use in cleaning railway coaches. It was designed to avoid the necessity for installing a special vacuum plant in car-cleaning yards. No special plant is required where this device is used, as sufficient air can be obtained from any ordinary line carrying compressed air, or it may even be connected to the air line of a locomotive. As seen in the accompanying cut, there are three connections, the top one being for the ¾-in. air supply hose. To the horizontal connection at the left is attached about 30 ft. of suction hose, on the end of which the sweeper is attached. The right hand end takes the exhaust line, about 6 ft. of 1-in. hose. The illustration of a car platform



Showing Method of Hose Connections.

shows these connections, and also the dust leaving the exhaust hose. By this arrangement it is not necessary to carry the heavier part of the apparatus about the car, but rather place it on the platform. A bag or vessel may be used to receive the sweepings or they may be allowed to blow into the air, as seen in the illustration.

The action within the device itself is the same as that of an injector. The air passes from the top out through the right hand end, causing a vacuum at the left hand end, to which is attached the suction hose and the sweeper. It is often necessary in cleaning a car to have a blast of air at the sweeper to blow dust out of corners, from behind piping, etc., and this condition is provided for through a cut-off valve placed between the intake and exhaust connections.



National Vacuum Car Cleaner.

By closing this valve, the air passes out through the suction instead of the exhaust end. After the dust is blown from the corners, it is then taken up by the suction, a simple opening of the cut-off valve being necessary.

The cost in air to operate this device is said to be about three cents per hour. A test showed that at 20 lbs. air pressure there were 9 1/5 cu. ft. of air used per minute; at 50 lbs. pressure, 17½ lbs. of air per minute and at 80 lbs. pressure, 25 lbs. of air per minute. These amounts are said to be about 20 per cent. less than that required for other devices made for this purpose. The National Vacuum Co., New York, maker of this device, also makes a portable one for house use, which may be used for car cleaning where electric power is available.

ANNUAL REPORT

ELEVENTH ANNUAL REPORT OF THE UNION PACIFIC RAILROAD COMPANY.

Income for the Year.

The gross receipts and disbursements of the Union Pacific Railroad and Auxiliary Companies, after excluding all offsetting accounts between them, were as follows:

	1908.	1907.
Average miles of rail line operated during the year	5,781.41	5,644.55
TRANSPORTATION OPERATIONS.		
Gross operating revenues	$74,422,776.81	$74,656,152.11
Outside operations—revenues	1,616,448.10	1,652,446.39
Total revenue	$76,039,224.91	$76,308,598.50
Operating expenses	$40,177,515.62	$38,628,099.72
Outside operations—expenses	1,516,519.67	1,520,478.51
Taxes (rail lines and property dealt with as outside operations)	2,444,725.87	2,076,945.17
Total expenses and taxes	$44,138,761.16	$42,225,523.40
Revenue over expenses and taxes	$31,900,463.75	$34,083,075.10
Fixed Charges.		
Interest on funded debt outstanding in the hands of the public	$11,245,899.39	$8,640,608.34
Sinking fund, Utah & Northern Ry. Co. Consolidated Mortgage	12,013.33	12,013.33
Hire of equipment—Balance	1,487,123.40	1,357,780.80
Total	$12,745,036.12	$10,010,402.47
Less—Rentals for lease of road, for joint tracks, yards and other facilities, viz.:		
Collections $671,106.22		
Payments 126,825.63	544,280.59	634,117.49
	$12,200,755.53	$9,376,284.98
Surplus after payment of fixed charges	$19,699,708.22	$24,706,790.12
Application of Surplus.		
Dividends on stocks of Union Pacific Railroad Co.:		
4 per cent. on preferred stock	$3,981,764.00	$3,981,764.00
6 per cent. on common stock	11,729,274.00	11,728,824.00
Dividends on stocks of the Oregon Railroad and Navigation Co. in the hands of the public:		
4 per cent. on preferred stock	94.00	232.00
	$15,711,132.00	$15,710,820.00
Surplus after payment of dividends	$3,988,576.22	$8,995,970.12
INCOME OTHER THAN FROM TRANSPORTATION OPERATIONS.		
Interest on bonds owned of companies other than Oregon Short Line Railroad and Oregon Railroad and Navigation Cos.	$1,143,063.81	$258,844.28
Dividends on stocks owned of companies other than Oregon Short Line Railroad and Oregon Railroad and Navigation Cos.	15,370,873.50	11,563,105.25
Rentals from steamships	249,131.60	136,231.40
Sales of unpledged lands and town sites	505.70	14,925.81
Total	$16,763,574.61	$11,973,106.74
Less—Balance of interest on loans and on open accounts other than with Auxiliary Companies	$540,225.73	$477,389.45
Miscellaneous expenses	203,657.33	25,586.53
	$743,883.06	$502,975.98
Balance	$16,019,691.55	$11,470,130.76
Deductions:		
Dividends on stocks of Union Pacific Railroad Co.:		
4 per cent. on common stock	7,819,516.00	7,819,216.00
Surplus	$8,200,175.55	$3,650,914.76
Total surplus from transportations and other income after payment of dividends	$12,188,751.77	$12,646,884.88
Applied as follows:		
Appropriated for betterments made during the year		$1,959,002.03
Net surplus	$12,188,751.77	$10,687,882.85

The difference in the distribution of revenues and expenses as provided for in the classification of "Operating Revenues" and of "Operating Expenses," promulgated by the Interstate Commerce Commission and made effective on July 1, 1907, and in the classification of the Commission in respect of operating expenses in effect prior thereto and observed by the Company, are such that the income for the year could not be understandingly compared with that of last year except by a restatement of last year's transportation operations under the classification observed this year. Thus restated, the results of the year's operations, compared with those of last year, are as follows:

	Increase.	Decrease.
Average miles of rail lines operated	136.86	
Gross operating revenues and revenues from outside operations		$269,373.59
Operating expenses and expenses of outside operations	$1,545,457.06	
Taxes	367,780.70	
Revenue over expenses and taxes		2,182,611.35
Income other than from transportation operations	4,549,560.79	
Total surplus	2,366,949.44	
Fixed charges	2,824,470.55	
Surplus over fixed charges		457,521.11

* *Assets and Liabilities.*

The assets and liabilities of the Union Pacific Railroad and Auxiliary Companies are shown in detail in Table No. 5. The securities of the Auxiliary Companies owned by the Union Pacific Railroad Co. and of the proprietary railways which are operated as an integral part of the system and are owned by the Union Pacific Railroad and Auxiliary Companies, as well as all offsetting accounts between the companies, are eliminated, thus dealing only with the securities in the hands of the public and the assets due from and the liabilities due to the public.

The increase or decrease in assets and liabilities since last report, briefly stated, is as follows:

Increase in Assets:		
Cost of railways, equipment, and appurtenances as shown in detail under "Capital Expenditures"		$12,542,757.89
Stocks and bonds owned: payment of the remaining 75 per cent. payable on subscription to $16,200,000 par value preferred stock of the Southern Pacific Company and for the purchase of stocks and bonds acquired during the year	$23,346,963.18	
Less: Proceeds from stocks and bonds sold	14,580,672.55	8,766,290.63
Loans to Southern Pacific Company	$42,376,389.27	
Loans to San Pedro, Los Angeles & Salt Lake R. R. Co.	2,575,308.33	44,951,697.60
Expenditures for construction of new lines and for terminal properties		6,600,530.13
Material and supplies		2,348,066.24
Current cash accounts		433,799.35
Unadjusted accounts		1,138,863.68
Due from Proprietary Companies		440,586.52
Total		$77,222,592.04
Deduction—		
Decrease in cash on hand	$3,124,914.24	
Rolling stock sold	4,245,304.97	7,370,219.21
Net increase in assets		$69,852,372.83
Increase in Liabilities:		
Funded debt	$97,043,567.94	
Reserve for depreciation and replacement of equipment	135,469.44	
	$97,179,037.38	
Deduction—		
Capital stock $2,700.00		
Loans paid off 27,860,574.10		
Current cash accounts 1,011,186.32		
Reserve funds written off 9,452,961.32	38,327,421.74	58,851,615.64
Increase in assets in excess of increase in liabilities (gain in Profit and Loss)		$11,000,757.19

Under the classification of Operating Revenues and Operating Expenses promulgated by the Interstate Commerce Commission in effect since July 1, 1907, the reserve funds established in former years for maintenance and renewals are not available for the payment of extraordinary repairs and renewals growing out of damages by floods and other exceptional causes. The sum to the credit of this reserve fund, amounting to $4,774,610.39, therefore, was written off and credited to Profit and Loss. The reserve funds established in former years for betterments, additions and new equipment, amounting to $4,678,350.93, were likewise written off and credited to Profit and Loss.

The Southern Pacific Company is engaged in the construction of railways in the Republic of Mexico under concessions and subventions which made it important, notwithstanding the monetary stringency

which existed last fall and winter, that the work should be prosecuted without interruption. To provide the funds for this work and for other important work it was deemed expedient to aid said company in temporarily financing its expenditures. The sum thus advanced amounted to $45,376,389.27 on June 30, 1908.

The state of the account in respect of the cost of the stock of the Northern Securities Company and of the stocks of the Great Northern Railway and of the Northern Pacific Railway Companies received in the distribution of the assets of the Securities Company, also in respect of the transactions growing out of the stocks subsequently acquired under subscription rights and of the proceeds from the sales of these stocks to June 30, 1908, is as follows:

Cost of 824,918.71 shares Northern Securities Co. stock		$79,459,691.36
Paid for:		
73,589.60 shares Great Northern Railway Company stock	$7,358,960.00	
Great Northern Railway Company subscription receipts for 2,600 shares	281,837.50	
Northern Pacific Railway Company subscription receipts for 34,516 shares	2,065,712.50	
		9,706,510.00
Total cost		$89,166,201.36
Amounts realized from stocks sold:		
100,000. shares Northern Securities Company stock	$16,880,019.46	
.18 shares Northern Securities Company stubs	56.13	
254,923.89 shares Great Northern Railway Company stock	60,594,950.13	
280,700.82 shares Northern Pacific Railway Company stock	54,822,614.97	
13,200. shares Great Northern Railway Company ore certificates	1,021,789.63	
Northern Pacific Railway Company subscription receipts for 16,500 shares	1,177,613.50	
Great Northern Railway Company subscription receipts for 2,000.60 shares	255,940.98	
		$134,752,984.80
Amount realized from sales in excess of the total cost of stocks (besides 35,786 shares Great Northern Railway Company stock, 77,164 shares Great Northern Railway Company ore certificates, 1,128 shares Northern Pacific Railway Company stock, Northern Pacific Railway Company subscription receipts, 62½ per cent. paid for 18,016 shares, and 7,249 shares Northern Securities Company stubs still on hand unsold)		$45,586,783.44

The Union Pacific Railroad and Auxiliary Companies own bonds, unpledged, to the amount of $81,966,500 face value.

The stocks and bonds owned, other than stocks and bonds of the Union Pacific Railroad and Auxiliary Companies, stand charged at the close of the year with $218,173,102.44, an increase during the year of $8,766,290.63. The details of the stocks and bonds owned (pledged or unpledged) and the increase or the decrease during the year are shown in tables attached to this report.

Capital Expenditures.

The charges to capital account, other than for stocks and bonds in companies other than the Union Pacific Railroad and Auxiliary Companies, were as follows:

Expenditures for account of the construction of railways taken over into cost of railways, equipment and appurtenances		$38,013.87
Cost of railways purchased in excess of amount included in previous reports under cost of railways, equipment and appurtenances, viz.:		
Leavenworth, Kansas & Western Railway	$373,309.95	
Topeka & Northwestern Railroad	312,916.92	
		686,226.87
Expenditures for account of extensions and cost of extensions transferred from free assets, viz.:		
Union Pacific Railroad Company:		
Cedar Rapids to Spalding, Nebraska	$165,920.85	
O'Fallons to Northport, Nebraska	1,449,693.19	
St. Vrain's Junction to Grant ine, Colorado	63,241.27	
Stromsburg to Central City, Nebraska	494,871.71	
Thayer to Horse Thief Canon, Wyoming	291,091.88	
		$2,464,818.90
Expenditures Oregon Short Line R.R. Co.: Kemmerer to North Kemmerer, Wyoming		206,626.33
Expenditures Oregon Railroad & Navigation Co.:		
Elgin to Joseph, Oregon	$269,657.30	
Less Credits:		
St. John's Extension, Oregon	$103.17	
St. John's to Troutdale, Ore.	1,333.48	
Lewiston to Grande Ronde River, Idaho	977.80	
	2,414.45	
	267,242.85	
		2,938,688.08
Expenditures for Additions and Betterments, viz.:		
Ballasting		$19,212.70
Bridges, trestles and culverts		588,735.25
Station buildings, terminal yards, shops and other buildings		884,979.73
Real estate		233,225.42
Fencing, telegraph lines, and shop machinery		149,902.96
Additional side and passing tracks		270,897.37
Additional main track		1,800,644.72
Changes in line, reducing grades and widening embankment		769,969.35
Interlocking and block signals	$874,052.36	
Water supply and pipe lines	75,284.28	
Additional cost of equipment added during the preceding fiscal year	21,971.71	
		5,688,876.85
Equipment transferred from deferred assets, viz.:		
168 locomotives	$2,761,045.02	
45 passenger train cars	426,087.73	
3,457 freight train cars	3,923,658.00	
		7,110,790.55
Adjustment in amount deducted from cost of railways, equipment and appurtenances on account of the difference between the face value of stocks and bonds of auxiliary companies, and the price at which they were taken over		26,925.06
Improvements to Northern Pacific Terminal property and Pintsch Gas Plant, Portland, Oregon		29,376.42
Adjustment in accounts taken over under reorganization		100,152.85
Total charges		$16,619,050.55
Credits:		
Amount received from Trustee of Union Pacific Railroad Company First Mortgage Four Per Cent. Bonds in payment for expenditures for betterments, improvements, equipment, etc., not otherwise provided for	$4,075,000.00	
Proceeds from sales of property	1,292.66	
		4,076,292.66
Net expenditures for capital account		$12,542,757.89

Equipment.

The changes in the equipment during the year were as follows:

		Added and charged to—			
	Condemned, etc.‡	Account— Replacement.	Capital.	Free assets.	Un. Pac. Equipment Association
Locomotives	16	4	175	*93	*33
Cars:					
Baggage	1	1	...	...	*1
Baggage & mail	1	7	2	...	5
Bag. & passngr	..	4	2	..	..
Bag.,mail & psgr	1	..	..	...	..
Business	..	..	..	1	..
Chair	..	..	..	..	5
Dining	..	..	3	..	*3
Instruction	..	..	3	..	*3
Motor	3	4	..	7	..
Observation	..	..	6	*5	..
Passenger	6	1	35	*19	15
Postal	2	2	6	*7	..
Box	696	36	2,943	*1,698	*227
Caboose	15	41	11	..	4
Flat	35	252	200	*250	100
Furniture	71	..	..	..	..
Gondola	249	..	..	..	..
Do., drop bottom	4	70	..	*70	..
Do., hop'r bot'm.	5	..	100	..	*100
Refrigerator	84	..	..	..	..
Stock	144	10	22	*30	..
Work equipment	166	522	403	*10	*100
Amount credited or charged	$606,093	$734,459	$7,329,880	*$3,755,635	*1,040,173[1]

*Credit.

[1] Grand total, credited or charged, $3,257,532.

‡Condemned, destroyed, sold or transferred and credited to replacement fund.

The locomotives added during the year averaged 97.40 tons total weight of engine without tender, and 84.29 tons upon drivers. The freight train cars added during the year averaged 50 tons capacity.

The locomotives and cars owned and their capacity at the close of the year were as follows:

	Year— This.	Last.	Increase.	Per cent.
Locomotives, standard gage	1,087	1,050	37	3.52
Locomotives, narrow gage	1	1	..	.....
Total	1,088	1,051	37	3.52
Standard Gage.				
Total weight, excluding tender, tons	89,701	85,419	4.282	5.01
Average total weight, excl. tender, tons	82.52	81.35	1.17	1.44
Total weight on drivers, tons	73,980	70,109	3,871	5.52
Av. total weight on drivers, tons	68.06	66.77	1.29	1.93
Passenger train cars, standard gage	702	642	60	9.35
Passenger train cars, narrow gage	1	1	....	.....
Total	703	643	60	9.33
Freight train cars, standard gage	25,482	25,371	111	.44
Freight train cars, narrow gage	6	6	..	.....
Total	25,488	25,377	111	.44
Total capacity, stand. gage cars, tons	901,862	864,955	36,907	4.27
Av'ge capacity, stand, gage cars, tons	36.01	34.64	1.37	3.95
Work equipment	3,598	2,929	669	22.84

Transportation Operations.

For the purpose of comparison, the revenues and expenses of this year are restated in the following tables under the classification in effect last year, deducting, however, from the expenses of last year such expenses as were then included in the operating expenses but which are this year charged to income account, also adjusting last year's expenses to the primary accounts of this year's classification as far as practicable.

Thus restated the results of the year's transportation operations compared with those of the preceding year are as follows:

	Year ended— June 30, 1908.	June 30, 1907.	Increase or *decrease.*	Per cent.
Average miles of rail lines operated	5,781.41	5,644.55	136.86	2.42

REVENUES.				
Passenger, including extra baggage	$16,641,467.67	$14,912,508.37	$1,728,959.30	11.59
Mail and express	3,956,151.20	4,143,581.72	*187,430.52*	4.52
Freight	52,899,157.66	54,809,073.72	*1,909,916.06*	3.48
Switching, rentals and all other sources	926,000.28	790,988.30	135,011.98	17.07
Total rail lines	$74,422,776.81	$74,656,152.11	*$233,375.30*	0.31
Outside operations—revenue	1,616,448.10	1,652,446.39	*35,998.29*	2.18
Total revenues	$76,039,224.91	$76,308,598.50	*$269,373.59*	0.35
OPERATING EXPENSES.				
Maintenance of way and structures	$8,898,300.54	$10,022,748.32	*$1,124,447.78*	11.22
Maintenance of equipment	7,991,447.19	7,867,080.64	124,366.55	1.58
Conducting transportation	21,214,178.96	18,780,079.56	2,434,099.40	12.96
General expenses	2,073,588.93	1,958,191.20	115,397.73	5.89
Total rail lines	$40,177,515.62	$38,628,099.72	$1,549,415.90	4.01
Outside operations—expenses	1,516,519.67	1,520,478.51	*3,958.84*	0.26
Total expenses	$41,694,035.29	$40,148,578.23	$1,545,457.06	3.85
Gross revenues over total expenses	$34,345,189.62	$36,160,020.27	*$1,814,830.65*	5.02
PASSENGER TRAFFIC.				
Revenue passengers carried	6,450,286	5,663,828	786,458	13.89
Revenue passengers carried one mile	760,532,906	680,278,509	80,254,397	11.80
Revenue from passenger trains per mile of road	$3,562.73	$3,376.02	$186.71	5.53
Revenue from passenger trains per *revenue train* mile*	$1.71	$1.77	*$0.06*	3.39
FREIGHT TRAFFIC.				
(*Way-bill Tonnage.*)				
Tons of revenue freight carried	13,089,163	14,089,649	*1,000,486*	7.10
Tons of revenue freight carried one mile	5,271,939,813	5,704,061,535	*432,121,722*	7.58
Revenue per mile of road	$9,149.87	$9,710.09	*$560.22*	5.77
Revenue per *revenue train* mile†	$4.31	$3.89	$0.42	10.80

* Revenue passenger train and *all* mixed train miles.
† Revenue freight train and *all* mixed train miles.
Decreases in *italics*.

The following statement shows the increase in the Company's revenues and service during the first half year and the shrinkage caused by the general business depression in the second half year.

	Gross revenue.	Tons of revenue freight carried	Tons revenue freight 1 mile.	Loco. miles revenue freight service incldg. Mexico.	No. of passengers—Carried.	No. of passengers—One mile.	Loco. miles revenue passgr service incldg. Mexico.
Six months ending December 31, 1907.	$42,919,295.84	7,751,263	3,065,584,431	8,237,359	3,470,230	431,603,877	6,511,477
" " " December 31, 1906.	39,063,650.57	7,237,099	2,851,997,966	7,687,492	2,933,135	361,092,813	5,660,359
" " " June 30, 1908.	33,119,929.07	5,337,900	2,206,355,382	5,348,964	2,980,056	328,929,029	6,103,849
" " " June 30, 1907.	37,244,947.93	6,852,550	2,852,063,569	8,085,844	2,730,693	319,185,696	5,584,652

The rail lines were operated for 53.99 per cent. of their gross revenue against 51.74 per cent. in 1907. The average for both rail and water lines, including outside operations, was 54.83 per cent. against 52.61 per cent. in 1907. Expenses for "maintenance" were 22.69 per cent., and for "operations" 31.30 per cent. of the gross revenues of the rail lines.

The increase of $1,545,457.06 in the operating expenses resulted entirely from the increase in expenses during the six months ended December 31, 1907. In the six months ended June 30, 1908, there was a decrease in operating expenses of $3,452,584.35. The increase in the first half year resulted from the expenses incident to the greater amount of traffic moved, which, in the preceding year, had already reached proportions where it exceeded the limit of handling it economically, from the greater cost of fuel and other material, from the higher wage schedules, and from the expenses of rebuilding the bridges and restoring to its former standard the roadway damaged by the disastrous floods and heavy snow storms in the spring of 1907.

In the following statements the expenses have been combined under accounts which present them concisely and comparatively with last year.

Maintenance of Way and Structures.

	This year.	Last year.
Repairs of roadway and track	$3,720,408.51	$4,802,706.39
Bridges, trestles and culverts	499,316.77	670,020.60
Ties	2,192,853.63	1,856,416.87
Rails, frogs, switches and fastenings	716,315.55	982,674.62
Buildings, grounds and appurtenances	1,390,806.47	1,288,399.06
Snow and sand fences, & snow sheds	14,349.53	21,687.76
Superintendence	350,632.46	384,802.73
Stationery and printing	13,617.62	16,040.29
Total	$8,898,300.54	$10,022,748.32

The increase for expenses for ties resulted from an increase in the average cost of ties from 66 cents to 75 cents per tie, an increase of 12.12 per cent., and from the greater number of ties put into the track.

The work done by the transportation department of the rail lines is shown in the following table:

	+ Increase. — Decrease.	Per cent.
Gross operating revenues	— $233,375.30	0.31
Expenses conducting transportation	+ 2,434,099.40	12.96
Revenue passengers carried one mile	+ 80,254,397	11.80
Mileage of passenger cars	+ 3,766,488	5.25
Locomotive mileage with passenger trains, including helping	+ 570,554	5.32
Tons of revenue freight carried one mile	— 432,121,722	7.58
Tons of revenue and company freight carried one mile	— 408,721,492	6.11
Mileage of freight cars	— 36,502,841	8.63
Locomotive mileage with freight and mixed trains, including helping	— 2,187,013	13.87
Total locomotive mileage in service for which the attendant expenses are charged to "Conducting Transportation"	— 1,683,549	5.38

The cost of fuel for locomotives per locomotive mile in revenue service and in non-revenue service for which the expenses are charged to "Conducting Transportation" was 22.239 cents per mile run against 16.524 cents in the preceding year and for the entire expenses for conducting transportation 71.674 cents against 60.040 cents in the preceding year.

General Expenses.

	This year.	Last year.
Salaries and expenses of general officers	$302,543.10	$272,850.38
Salaries & expenses of clerks & attendants	930,005.03	775,740.18
Law expenses	238,102.24	268,657.10
General office expenses	103,852.44	99,226.89
Stationery and printing	139,649.81	94,224.19
Insurance	161,615.45	207,637.71
Other expenses	197,820.86	239,854.75
Total	$2,073,588.93	$1,958,191.20

General.

The delivery of the remaining 3,000 refrigerator cars for the "Pacific Fruit Express Company," referred to in the last annual report, was completed during the year, and the company now has 6,600 cars in service. The paid-up capital stock of the company is $10,800,000, paid for by the Union Pacific Railroad Company and the Southern Pacific Company, one-half each.

ASSETS AND LIABILITIES, JUNE 30, 1908.

(Excluding stocks and bonds owned of auxiliary and proprietary railways and all offsetting accounts between them.)

Assets—Capital Assets.	June 30, 1908.	June 30, 1907.
Cost, railways, equip. & appurtenances*	$385,907,655.61	$373,774,563.64
Cost of extensions	1,700,355.17	1,290,689.25
Stocks and bonds owned.†	218,173,102.44	209,406,811.81
Trust funds	328,563.86	300,464,54
	$606,109,677.08	$584,772,520.24
Current Assets.		
Demand loans, Southern Pacific Co.	$45,376,389.27	$3,000,000.00
Loans to San Pedro, Los Angeles & Salt Lake R.R. Co.	2,625,308.33	50,000.00
Cash	4,395,934.40	7,520,848.64
Bills receivable	$8,929.90	$8,929.90
Agents and conductors	1,014,043.59	852,800.05
Traffic balances	.....	212,334.90
Dividends and interest, to June 30th	4,849,453.25	3,738,932.50
Individuals and companies	2,536,319.86	3,170,186.43
U. S. Government transportation	1,049,592.42	1,069,455.21
Material, fuel and supplies	12,232,475.62	9,884,409.38
	$74,088,446.64	$29,507,897.01
Deferred Assets.		
Advances for the construction and acquisition of new lines	$33,013,620.92	$26,390,035.46
Ocean steamships "Manchuria" and "Mongolia"	5,126,796.58	5,126,796.58
Rolling stock	7,258,275.44	11,503,580.41
Land and miscellaneous property	6,771.43	6,935.43
Individuals and companies	9,824.27	32,715.60
Due from proprietary companies	790,487.19	884,659.15
	$46,205,775.83	$43,944,722.63
Contingent Assets.		
Unadjusted accounts	$1,457,894.52	$319,030.84
Land and town lot contracts	3,542,429.21	3,281,855.33
	$5,000,323.73	$3,600,886.17
Total assets	$731,404,223.28	$661,826,035.05

†As detailed in later tables.
*From year to year this cost has been written down by $11,327,036.56 received to date from the Improvement and Equipment Fund and by appropriations from "Income Account" amounting to $16,959,816.24—a total of $28,286,852.80.

Liabilities—Capital Liabilities.	June 30, 1908.	June 30, 1907.
Union Pacific Railroad Company:		
Common stock	$195,487,900.00	$195,477,900.00

Preferred stock	$99,544,100.00	$99,544,100.00
Stocks of Auxiliary Companies in hands of the public, viz.:		
Oregon Short Line Railroad Co.:		
Common stock	.....	10,000.00
Oregon R.R. & Navigation Co.:		
Common stock	20,100.00	20,200.00
Preferred stock	3,410.00	6,010.00
Funded debt (excluding bonds of Auxiliary and Proprietary Cos. owned) Table No. 14.	298,109,067.94	201,065,500.00
	$593,164,577.94	$496,123,710.00
Current Liabilities.		
Traffic balances	$100,749.09	.....
Coupons matured but not presented	149,145.15	$172,102.65
Coupons due July 1st	4,028,005.00	2,528,005.00
Interest accrued on bonds and loans to June 30.	1,392,039.38	1,878,815.74
Dividends due but uncalled for	38,836.00	33,660.50
Dividends payable July 1st and Oct. 1st	11,765,277.00	11,765,105.00
Bonds satisfied of mortgage	3,000.00	3,000.00
Loans and bills payable	41,189,645.90	69,050,220.00
Vouchers and pay rolls	4,112,357.27	6,221,595.98
	$62,779,054.79	$91,652,504.87
Deferred Liabilities.		
Taxes assessed but not due	$1,085,066.52	$985,212.64
Contingent Liabilities.		
Insurance fund (Table No. 23)	$416,506.41	$492,076.93
Trust accounts	54,027.45	81,918.78
Equipment replacement funds	97,683.39	204,329.31
Reserve for depreciation on steamships and rolling stock leased	1,353,769.60	1,111,654.24
Reserve fund for betterments, additions and new equipment.	.....	4,678,350.93
Reserve fund for maintenance, renewals, etc.	.....	4,774,610.39
Hospital fund	81,878.63	76,581.00
Union Pacific Coal Co.	1,736,885.11	2,848,829.45
Union Pacific Land Co.	53,559.47	2,081,559.47
Due to proprietary companies	3,060,205.96	455,020.10
Principal of deferred payments on land and town lot contracts (Table No. 19)	3,542,429.21	3,281,855.33
	$10,396,945.23	$20,086,785.93
Balance to credit of profit and loss (Table No. 4)	$63,978,578.80	$52,977,821.61
Total liabilities	$731,404,223.28	$661,826,035.05

EXPENDITURES.

Capital Expenditures.

Expenditures for construction and acquisition of new lines	$1,340,717.35	
Betterments and additions	5,688,876.75	
Equipment	7,110,790.65	
Cost of new lines transferred from deferred assets	2,351,587.89	
Adjustment in accounts taken over under reorganization	100,152.85	
Adjustment in other accounts	26,925.06	
Total	$16,619,050.55	
Deduct for:		
Received from improvement and equipment fund	$4,075,000.00	
Proceeds from sales of miscellaneous property	1,292.66	
Total	$4,076,292.66	$12,542,757.89

Increase in Assets.

Loans to Southern Pacific Co.	$42,376,389.27	
Loans to San Pedro, Los Angeles & Salt Lake R. R. Co.	2,575,308.33	
Stocks and bonds owned	8,766,290.63	
Material, fuel and supplies	2,348,066.24	
Advances for construction of new lines	6,600,530.13	
Current cash accounts	$433,799.35	
Due from Proprietary Companies	440,586.52	
Unadjusted accounts	1,138,863.68	
Total	$64,679,834.15	
Deduct for:		
Decrease in cash on hand	$3,124,914.24	
Rolling stock transferred to capital expenditures	4,245,304.97	
Total	$7,370,219.21	57,309,614.94

Decrease in Liabilities.

Loans paid off	$27,860,574.10	
Current cash accounts	1,011,186.32	
Reserve funds written off	9,452,961.32	
Total	$38,324,721.74	
Deduct for:		
Increase in reserve for depreciation and replacement of equipment	135,469.44	38,189,252.30
Total		$108,041,625.13

RECEIPTS.

Capital Liabilities.

U. P. R. R. Co. Twenty Year Four Per Cent. Convertible Bonds sold	$73,762,000.00	
U. P. R. R. Co. First Lien and Refunding Four Per Cent. Bonds sold	23,296,567.94	
U. P. R. R. Co. common stock issued in exchange for an equal amount of O. S. L. R. R. Co. capital stock	10,000.00	
	$97,068,567.94	
Deduct for:		
O. S. L. R. R. Co. Income "A" Bonds acquired	$14,000.00	
O. S. L. R. R. Co. Income "B" Bonds acquired	1,000.00	
O. S. L. R.R. Co. capital stock acquired.	10,000.00	
O. R. R. & N. Co. common stock acquired	100.00	
O. R. R. & N. Co. preferred stock acquired	2,600.00	
	$27,700.00	$97,040,867.94

Profit and Loss.

Gross operating revenues and revenues from outside operations	$76,039,224.91	
Interest, dividends and other income	16,177,890.47	
Total receipts	$92,217,115.38	
Deduct for:		
Operating expenses and expenses of outside operations	$41,641,487.37	
Taxes	2,444,725.87	
Interest on funded debt and sinking fund requirements	11,257,912.72	
Dividends on preferred and common stocks	23,530,648.00	
Discount and commissions on bonds sold	10,979,721.71	
Miscellaneous expenses and charges	814,823.84	
Total charges	$90,669,319.51	
Less:		
Reserve fund for maintenance and renewals written off	$4,774,610.39	
Reserve fund for betterments, additions and new equipment written off	4,678,350.93	
	*$9,452,961.32	
Balance	$81,216,358.19	11,000,757.19
Total		$108,041,625.13

* Under the classification of Operating Revenues and Operating Expenses promulgated by the Interstate Commerce Commission in effect since July 1, 1907, the reserve funds established in former years for maintenance and renewals are not available for the payment of extraordinary repairs and renewals growing out of damages by floods and other exceptional causes. The sum to the credit of this reserve fund, amounting to $4,774,610.39, therefore, was written off and credited to Profit and Loss. The reserve funds established in former years for betterments, additions and new equipment, amounting to $4,678,350.93, were likewise written off and credited to Profit and Loss.

PROFIT AND LOSS FOR THE YEAR ENDED JUNE 30, 1908.

Discount and commission on $73,762,000 face value 20-year 4 per cent. convertible bonds and $23,296,567.94 face value 1st lien and refunding 4 per cent. bonds sold and delivered during the year		$10,979,721.71
Balance of adjustment in charges for depreciation of equipment		33,569.65
Surveys charged off		19,711.31
Miscellaneous payments		6,770.00
Uncollectible accounts written off		10,889.82
Balance, June 30, 1908, viz.:		
Income account	$63,027,695.43	
Sinking fund	950,883.37	
		63,978,578.80
		$75,029,241.29

Balance, June 30, 1907		$52,977,821.61
Balance income from transportation operations	$3,988,576.22	
Balance income other than from transportation operations	8,200,175.55	12,188,751.77
Sinking fund contributions and income from sinking fund investments		21,795.89
Profit from sale of securities		167,773.09
Reserve fund for betterments, additions and new equipment written off		*4,678,350.93
Reserve fund for maintenance, renewals, etc., written off.		*4,774,610.39
Contingent liabilities written off		200,000.00
Miscellaneous collections		6,434.28
Adjustments in accounts		8,029.84
Proceeds from sale of unpledged lands and town sites		5,673.49
		$75,029,241.29

*Under the classification of Operating Revenues and Operating Expenses promulgated by the Interstate Commerce Commission in effect since July 1, 1907, the reserve funds established in former years for maintenance and renewals are not available for the payment of extraordinary repairs and renewals growing out of damages by floods and other exceptional causes. The sum to the credit of this reserve fund, amounting to $4,774,610.39, therefore, was written off and credited to Profit and Loss. The reserve funds established in former years for betterments, additions and new equipment, amounting to $4,678,350.93, were likewise written off and credited to Profit and Loss.

GENERAL OPERATING RESULTS, YEAR ENDED JUNE 30, 1908.

		June 30,1908.	June 30, 1907.	Increase.	Decrease.	Per Ct.
	Average miles of rail lines operated	5,781.41	5,644.55	136.86	.....	2.42
	REVENUE AND EXPENSES. (Rail lines and outside operations.)					
1.	Gross revenues	$76,039,224.91	$76,308,598.50	.....	$269,373.59	.35
2.	Gross expenses	41,694,293.89	40,148,578.23	$1,545,715.66	.....	3.85
3.	Revenues over expenses	34,344,931.02	36,160,020.27	.....	1,815,089.25	5.02
4.	Ratio of expenses to gross revenues	54.83	52.61	2.22	.....	4.22
	(*Rail Lines only.*)					
5.	Total operating revenues	$74,422,776.81	$74,656,152.11	.....	$233,375.30	.31
6.	Operating expenses	40,177,515.62	38,628,099.72	$1,549,415.90	.....	4.01
7.	Net operating revenue	34,245,261.19	36,028,052.39	.....	1,782,791.20	4.95
8.	Ratio of operating expenses to total operating revenues	53.99	1.74	2.25	.....	4.34
9.	Operating revenues per mile of road	12,872.77	13,226.24	.....	353.47	2.67
10.	Operating expenses per mile of road	6,949.43	6,843.43	106.00	.....	1.55
11.	Net operating revenue per mile of road	5,923.34	6,382.81	.....	459.47	7.20
12.	Operating revenues per *revenue train* mile (*a*)	3.23	3.07	16	.....	5.21
13.	Operating expenses per *revenue train* mile (*a*)	1.74	1.59	15	.....	9.45
14.	Net operating revenue per *revenue train* mile (*a*)	1.49	1.48	.01	.....	.68
	TRAIN AND LOCOMOTIVE MILES.					
15.	Revenue service—Total freight train miles	10,972,701	13,569,398	.....	2,596,697	19.14
16.	Revenue service—Passenger train miles	10,767,832	10,231,416	536,416	.....	5.24
17.	Revenue service—Mixed train miles	1,295,456	517,458	777.998	.....	150.35
18.	Revenue service—Special train miles	28,282	.....	28,282		
19.	Revenue service—*Total train miles* (*a*)	23,064,271	24,318,272	.....	1,254,001	5.16
20.	Revenue service freight—Light and helping locomotive miles	1,296,403	1,686,480	.....	390,077	23.13
21.	Revenue service passenger—Light and helping locomotive miles	530,275	496,137	34,138	.....	6.88
22.	Revenue service mixed—Light and helping locomotive miles	21,763	.....	21,763		
23.	Revenue service special—Light and helping locomotive miles	9,442	.....	9,442		
24.	Revenue service—*Total locomotive miles* excluding switching	24,922,154	26,500,889	.....	1,578,735	5.96
25.	Revenue service—Switching locomotive miles	4,179,542	4,414,733	.....	235,191	5.33
26.	Revenue service—*Total locomotive miles*	29,101,696	30,915,622	.....	1,813,926	5.87
27.	Non-revenue service—Locomotive miles included in Conducting "Transportation Expenses" (*d*)	496,575	366,198	130,377	.....	35.60
28.	Ratio of *light and helping* locomotive miles to *revenue service* total *train miles*	8.06	8.98	.....	.92	10.24
29.	Ratio of *helping miles* to *revenue service* total *train miles* excluding *running light*	3.27	4.06	.....	.79	19.46
	CAR MILES.					
30.	Revenue service—Freight car miles—loaded	279,025,230	316,173,710	.....	37,148,480	11.75
31.	Revenue service—Freight car miles—empty	96,517,578	93,608,067	2,909,511	.....	3.11
32.	Revenue service freight—Caboose car miles	10,913,724	13,177,596	.....	2,263,872	17.18
33.	Revenue service—Total freight car miles	386,456,532	422,959,373	.....	36,502,841	8.63
34.	Non-revenue service—Total freight car and caboose miles	1,000,021	.....	1,000,021		
35.	Total freight car and caboose miles	387,456,553	422,959,373	.....	35,502,820	8.39
36.	Revenue service—Passenger car miles (*b*)	75,547,015	71,780,527	3,766,488	.....	5.25
37.	Non-revenue service—Passenger car miles	542,560	575,669	.....	33,109	5.75
38.	Revenue service—Special car miles—freight and caboose	370,952	.....	370,952		
39.	Revenue service—Special car miles—passenger	111,310	.....	111,310		
40.	Revenue service—Total special car miles	482,262	.....	482,262		
41.	Average number of cars in passenger trains	6.26	6.68	.....	.42	6.29
42.	Average number of loaded cars in freight trains—East or North	22.17	21.91	.26	.....	1.19
43.	Average number of loaded cars in freight trains—West or South	23.33	22.98	.35	.....	1.52
44.	Average number of loaded and empty freight cars in freight trains (excluding caboose)	30.61	29.09	1.52	.....	5.23
45.	Average number of loaded freight cars in freight trains	22.74	22.44	.30	.....	1.34
46.	Ratio of loaded freight car mileage to total freight car mileage (*e*)	74.30	77.16	.....	2.86	3.71
47.	Ratio of empty freight car mileage to total freight car mileage (*e*)	25.70	22.84	2.86	.....	12.52
	MISCELLANEOUS.					
48.	Average cost of maintenance of way and structures per mile of first and second track	$1,450.71	$1,707.71	.....	$257.00	15.05
49.	Average cost of repairs and replacements per locomotive per annum (*c*)	3,068.90	2,932.92	$135.98	.....	4.64
50.	Average cost of repairs and replacements per passenger train car per annum (*c*)	1,036.64	1,092.31	.....	55.67	5.10
51.	Average cost of repairs and replacements per freight train car per annum (*c*)	113.22	126.87	.....	13.65	10.76
52.	Conducting transportation per revenue service total *train mile* (*a*)	91.98 cents	77.23 cents	14.75 cents	.....	19.10
53.	Conducting transportation per *locomotive mile* included in "Conducting Transportation Expenses" (*d*)	71.67 cents	60.04 cents	11.63 cents	.....	19.37

(*a*) Includes revenue and *all* mixed train miles, but excludes mileage of locomotives helping, as prescribed by the Interstate Commerce Commission of the United States. (*b*) Includes mileage of passenger cars in revenue service passenger, freight and mixed trains. (*c*) Includes value of equipment condemned, destroyed or sold. (*d*) Includes mileage run with pay, inspection and other official trains, and mileage of material and supply trains, as the expenses incurred in hauling such trains are included in expenses for Conducting Transportation. (*e*) Excludes non-revenue and caboose mileage.

INVESTMENT STOCKS OWNED, JUNE 30, 1908.

	Owned by Union Pacific R.R. and Auxiliary Companies				Of total owned there are	
	Union Pacific R. R. Co.	Ore. Short Line R.R. Co.	Total.	Inc. (+), or dec. (—).	Pledged.	Unpledged.
Atchison, Topeka & Santa Fe Ry. Co., preferred stock	.....	$10,000,000	$10,000,000	.....	.....	$10,000,000
Baltimore & Ohio R.R. Co., common stock	.....	32,334,200	32,334,200	.....	.....	32,334,200
Preferred stock	.....	7,206,400	7,206,400	.....	.....	7,206,400
Chicago & Alton R.R. Co., preferred stock	$10,343,100	.....	10,343,100	.....	.....	10,343,100
Chicago & Northwestern Ry. Co. common stock	.....	3,215,000	3,215,000	.....	.....	3,215,000
Chicago, Milwaukee & St. Paul Ry Co., common stock	.....	1,340,000	1,340,000	—$2,350,000	.....	1,340,000
Common stock (65 per cent paid)	.....	3,272,500†	3,272,500†	+ 2,350,000†	.....	†3,272,500
Preferred stock (65 per cent paid)	.....	1,845,000†	1,845,000†	.....	.....	†1,845,000
Great Northern Ry. Co. preferred stock	.....	3,578,600	3,578,600	—9,072,360	.....	3,578,600
Iron Ore certificates, 77,164 shares.*	.....	.....	.....	.....	.....	.....
Illinois Central R.R. Co., capital stock	20,123,100	.....	20,123,100	+1,500,000	.....	20,123,100
N. Y. Central & Hudson River R.R. Co., capital stock	.....	14,285,700	14,285,700	.....	.....	14,285,700
Northern Pacific Ry. Co., common stock	.....	112,800	112,800	—4,040,000	.....	112,800
Common stock 62½ per cent paid	.....	1,801,600†	1,801,600†	—690,000†	.....	†1,801,600
Northern Securities Co. stubs	.....	724,900	724,900	.....	.....	724,900
Railroad Securities Co. common stock	3,482,900	.....	3,482,900	+67,500	.....	3,482,900
Preferred stock	1,935,900	.....	1,935,900	+37,500	.....	1,935,900
Southern Pacific Co. common stock	.....	90,000,000	90,000,000	.....	$90,000,000‡	.....
Preferred stock	.....	34,200,000	34,200,000	.....	18,000,000‡	16,200,000
Total, 1908	$35,885,000	$203,916,700	$239,801,700	—$12,197,360	$108,000,000	$131,801,700
Total, 1907	34,280,000	217,719,060	251,999,060	.....	108,000,000	143,999,060

*Par value of shares not stated in certificate. †Full par value of stocks. ‡Deposited as collateral under Oregon Short Line R. R. Co. 4 per cent. refunding mortgage. Of the total $100,000,000 outstanding bonds, $55,000,000 are a free asset in the treasury of the Union Pacific Railroad Co.

STOCKS OWNED OF OTHER COMPANIES, JUNE 30, 1908.

	Amount in hands of public, June 30, 1908.	Owned by Union Pacific R.R. and Auxiliary Companies. Union Pacific R. R. Co.	Oregon Short Line R.R. Co.	Total.	Inc. (+), or dec. (—).	Of total owned there are Pledged.	Unpledged.
Caliente & Pioche R.R. Co.: Capital stock	$15,000.00	.....	$15,000.00	$15,000.00	.....	.....	$15,000.00
Grays Harbor & Puget Sound R.R. Co.: Capital stock	.....	$10,000.00	.....	10,000.00	.....	.....	10,000.00
Greene River Water-Works Co.: Capital stock	.....	225,000.00	.....	225,000.00	.....	.....	225,000.00
Ilwaco Railroad Co.: Capital stock	.....	152,500.00	.....	152,500.00	.....	.....	152,500.00
Kansas City Terminal Railway Co.: Capital stock	100,000.00	100,000.00	.....	100,000.00	.....	.....	100,000.00
Leavenworth, Kan. & Westn Ry.Co.: Capital stock	.....	.....	.....	.....	— $1,000,000.00	.....	.....
Leavenworth & Topeka Ry. Co.: Capital stock	25,000.00	25,000.00	.....	25,000.00	.....	.....	25,000.00
Leavenworth Depot & R. R. Co.: Capital stock	100,000.00	50,000.00	.....	50,000.00	.....	.....	50,000.00
Occidental & Oriental Steamship Co.: Capital stock	1,250,000.00	8,750,000.00	.....	8,750,000.00	.....	.....	8,750,000.00
Ogden Union Ry. & Depot Co.: Capital stock	150,000.00	150,000.00	.....	150,000.00	.....	.....	150,000.00
Oregon & Washington R.R. Co.: Capital stock	.....	1,000,000.00	.....	1,000,000.00	.....	.....	1,000,000.00
Pacific Express Co.: Capital stock.	3,600,000.00	2,400,000.00	.....	2,400,000.00	.....	.....	2,400,000.00
Pacific Fruit Express Co.: Capital stock	10,800,000.00	5,400,000.00	.....	5,400,000.00	+ 4,800,000.00	.....	5,400,000.00
Rattlesnake Creek Water Co.: Capital stock	.....	78,300.00	.....	78,300.00	.....	.....	78,300.00
St. Joseph & Grand Isld R.R. Co.: Common stock	4,600,000.00	2,900,000.00	.....	2,900,000.00	.....	.....	2,900,000.00
First preferred stock	5,498,500.00	932,200.00	.....	932,200.00	.....	.....	932,200.00
Second preferred stock	3,500,000.00	1,250,000.00	.....	1,250,000.00	.....	.....	1,250,000.00
San Pedro, Los Angeles & Salt Lake R. R. Co.: Capital stock	12,500,000.00	.....	12,500,000.00	12,500,000.00	.....	.....	12,500,000.00
Short Line Land & Improvemt Co.: Capital stock.	50,000.00	.....	50,000.00	50,000.00	.....	.....	50,000.00
Spokane Union Depot Co.: Capital stock	.....	125,000.00	.....	125,000.00	.....	.....	125,000.00
Topeka Iron Co.: Capital stock	55,000.00	55,000.00	.....	55,000.00	.....	.....	55,000.00
Union Depot & Ry. Co.(Denver) Capital stock	160,000.00	240,000.00	.....	240,000.00	.....	.....	240,000.00
Union Depot Co.(Kansas City): Capital stock	450,000.00	45,000.00	.....	45,000.00	.....	.....	45,000.00
Union Land Co.: Capital stock	.....	10,000.00	.....	10,000.00	.....	.....	10,000.00
Union Pacific Coal Co.: Capital stock	.....	5,000,000.00	.....	5,000,000.00	.....	.....	5,000,000.00
Un. Pac. Equipment Association: Capital stock	.....	100,000.00	.....	100,000.00	.....	.....	100,000.00
Union Pacific Land Co.: Capital stock	.....	100,000.00	.....	100,000.00	.....	$99,400.00	600.00
Union Pacific Water Co.: Capital stock	.....	500.00	.....	500.00	.....	.....	500.00
Utah Light & Ry. Co.: Common stock	.....	.....	1,849,450.00	1,849,450.00	+ 1,849,450.00	.....	1,849,450.00
Preferred stock	.....	.....	3,836,300.00	3,836,300.00	+ 3,836,300.00	.....	3,836,300.00
Washington Union Coal Co.: Capital stock.*	.....	.....	.....	.....	—170,200.00	.....	.....
Total, 1908	.....	$29,098,500.00	$18,250,750.00	$47,349,250.00	+ $10,485,750.00	$99,400.00	$47,249,850.00
Total, 1907	.....	24,298,500.00	12,565,000.00	36,863,500.00	.....	99,400.00	36,764,100.00

*Sold to Union Pacific Coal Company.

BONDS OWNED OF OTHER COMPANIES, JUNE 30, 1908.

	Amount in hands of public, June 30, 1908.	Owned by Union Pacific R.R. and Auxiliary Companies. Union Pacific R. R. Co.	Oregon Short Line R.R. Co.	Total.	Inc. (+), or dec. (—).	Of total owned there are Pledged.	Unpledged.
Atchison Union Depot & R.R. Co.: Second mortgage, 5 per cent.	$31,500.00	$4,500.00	.....	$4,500.00	.....	.....	$4,500.00
Cheyenne County, Colo: Refunding 5 per cent.	.....	26,200.00	.....	26,200.00	.....	.....	26,200.00
Chicago & Alton R. R. Co.: Debenture 5 per cent.	.....	147,000.00	.....	147,000.00	+ $147,000.00	.....	147,000.00
Green River Water-Works Co.: First moregage 6 per cent.	.....	198,000.00	.....	198,000.00	—10,000.00	.....	198,000.00
Idaho Northern R.R. Co.: First Mortgage 5 per cent.	.....	143,000.00	.....	143,000.00	+ 143,000.00	.....	143,000.00
Ilwaco Railroad Co.: First mortgage 6 per cent.	.....	305,000.00	.....	305,000.00	.....	.....	305,000.00
Leavenworth & Topeka Ry. Co.: First mortgage 4 per cent.	250,000.00	125,000.00	.....	125,000.00	+ 22,500.00	.....	125,000.00
Leavenworth Depot & R.R. Co.: First mortgage 5 per cent.	87,000.00	63,000.00	.....	63,000.00	.....	.....	63,000.00
Northern Pacific Terminal Co.: First mortgage 6 per cent.	.....	58,000.00	.....	181,000.00	+ 13,000.00	.....	181,000.00
Ogden Union Ry. & Depot Co.: First mortgage 5 per cent.	163,000.00	163,000.00	.....	163,000.00	.....	.....	163,000.00
Payette Valley Ry. Co.: First mortgage 5 per cent.	.....	.....	$44,000.00	44,000.00	.....	.....	44,000.00
Rattlesnake Creek Water Co.: First mortgage 6 per cent.	.....	146,000.00	.....	146,000.00	.....	.....	146,000.00
San Pedro, Los Angeles & Salt Lake R.R. Co.: 1st mort. 4 per cent	.....	.....	20,000,000.00	20,000,000.00	.....	.....	20,000,000.00
Utah Light & Power Co.: Consolidated mortgage 4 per cent.	.....	.....	1,500.00	1,500.00	+ 1,500.00	.....	1,500.00
Utah Light & Ry. Co.: Consolidated mortgage 5 per cent.	.....	.....	993,000.00	993,000.00	+ 993,000.00	.....	993,000.00
Collateral trust 6 per cent.	.....	.....	41,000.00	41,000.00	+ 41,000.00	.....	41,000.00
Union Pacific Coal Co.: First mortgage 5 per cent.	*1,158,000.00	3,842,000.00	.....	3,842,000.00	—136,000.00	.....	3,842,000.00
Union Pacific Land Co.: First mortgage 4 per cent.	.....	7,400,000.00	.....	7,400,000.00	—2,600,000.00	$7,400,000.00	.....
Total, 1908	.....	$12,620,700.00	$21,079,500.00	$33,823,200.00	—$1,385,000.00	$7,400,000.00	$26,423,200.00
Total, 1907	.....	15,039,200.00	20,044,000.00	35,208,200.00	.....	10,000,000.00	25,208,200.00

*Held by Union Pacific Coal Co. sinking fund. NOTE.—The Oregon R. R. & Nav. Co., owns $123,000 Northern Pacific Terminal Co. first mortgage 6 per cent bonds, and owned in 1907, $125,000 of these bonds.